EXHIBIT 4.10

FERC FEIS for MIDSHIP Project (continued)

APPENDIX N
LIST OF PREPARERS

Federal Energy Regulatory Commission (FERC or Commission)

Baum, Elaine – Environmental Project Manager, Proposed Action, Land Use, Cumulative Effects
M.P.A., 2006, Florida State University
B.S., Environmental Policy and Planning, 2004, Virginia Tech

Cotton, Douglas – Environmental Deputy Project Manager, Alternatives, Socioeconomics
M.S., Urban and Regional Planning, 1980, University of Wisconsin, Madison
B.A., Geography, 1977, University of Massachusetts, Amherst

Armbruster, Ellen – Cultural Resources
M.A., Anthropology, 1986, University of Pennsylvania
B.A., Anthropology, 1979, Bryn Mawr College

Barakat, Kandilarya – Air Quality, Noise, Reliability and Safety
M.E., Environmental Engineering/Project Management, 2006, University of Maryland, College Park
B.S. Chemical Engineering, 2003, University of Maryland, College Park

McDaniel, Nina – Air Quality, Noise, Reliability and Safety
M.S., Engineering Management, 2012, University of New Orleans
B.S., Civil Engineering, 2010, University of New Orleans

Rana, Anthony – Geology, Groundwater, Soils
M.S., International Development, 2012, Tulane University
Graduate Studies, Hydrogeology and Geochemistry, 1985 to 1988, Oklahoma State University
B.S., Geology, 1984, New Jersey City University

Suter, Maggie – Air Quality, Noise, Reliability and Safety
B.S., Environmental Systems Engineering, 2004, Penn State

Wachholder, Joanne – Surface Water and Wetlands, Wildlife and Vegetation, and Special Status Species
M.S., Crop and Soil Sciences – Environmental Toxicology, 1997, Michigan State University
B.S., Environmental Biology, 1994, University of Wisconsin at Stevens Point

FERC Third-Party Contractor – Environmental Resources Management, Inc.

Lyons, Tina – Project Manager, Proposed Action, Land Use, Conclusions and Recommendations
B.S., Genetics and Cell Biology, 1999, University of Minnesota
B.S., Ecology, Evolution, and Behavior, 1996, University of Minnesota

Buckless, Michael – Deputy Project Manager, Geology, Soils
B.S., Environmental Science and Management, 2013, University of Rhode Island

Lee, Jennifer – Principal
B.S., Environmental Studies and Geography, 1995, St. Thomas University

Bakken, Justin – Geographic Information Systems
M.A., Geographic Information Science, 2011, University of Minnesota
B.A., Biology, 2002, Grinnell College

APPENDIX N (cont'd)

Born, Nate – Air Quality, Noise
B.S., Civil Engineering, 2014, Louisiana State University
B.S., Computer Science, 2010, University of Minnesota

Colwell, Lauren – Geology, Groundwater
M.S., Geology/Environmental and Natural Resources, 2013, University of Wyoming
B.A., Geology and Archaeology, 2009, Carleton College

Enright, Troy – Air Quality, Noise
B.S., Environmental Science, 2003, University of Minnesota

Huff, Jenifer – Socioeconomics
B.S., Pennsylvania State University, 1979, Urban and Regional Planning

Ingham, Alissa – Land Use
B.S., Environmental Management and Protection, 2012, California Polytechnic State University, San Luis Obispo

Ingham, Reina – Cumulative Effects
B.S., Environmental Management and Protection, 2013, California Polytechnic State University, San Luis Obispo

Jensen, Bart –Alternatives
B.S., Natural Resources and Environmental Studies, 1992, University of Minnesota

Nickel, Dave – Reliability and Safety
B.L.A., Environmental Studies, 2002, University of Minnesota at Duluth

Rieland, Janelle – Special Status Species
B.S., Fisheries and Wildlife, 2002, University of Minnesota

Sullivan, Andrew – Surface Water, Wetlands, Wildlife, Vegetation
B.S., Biology and Zoology, 2008, University of Wisconsin, Madison

Sussman, Ben – Socioeconomics
MCRP, 2002, Georgia Tech
B.S., Science, Technology, and Society, 1998, Stanford University

Thyse, DeAnn
M.A., Anthropology, 2008, University of Minnesota
B.A., Anthropology, 1993, University of Wisconsin, Madison

Environmental Resources Management, Inc. is a third-party contractor assisting the Commission staff in reviewing the environmental aspects of the project application and preparing the environmental documents required by the National Environmental Policy Act. Third-party contractors are selected by Commission staff and funded by project applicants. Per the procedures in Title 40 Code of Federal Regulations Part 1506.5(c), third-party contractors execute a disclosure statement specifying that they have no financial or other conflicting interest in the outcome of the project. Third-party contractors are required to self-report any changes in financial situation and to refresh their disclosure statements annually. The Commission staff solely directs the scope, content, quality, and schedule of the contractor's work. The Commission staff independently evaluates the results of the third-party contractor's work and the Commission, through its staff, bears ultimate responsibility for full compliance with the requirements of the National Environmental Policy Act.

APPENDIX O

RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

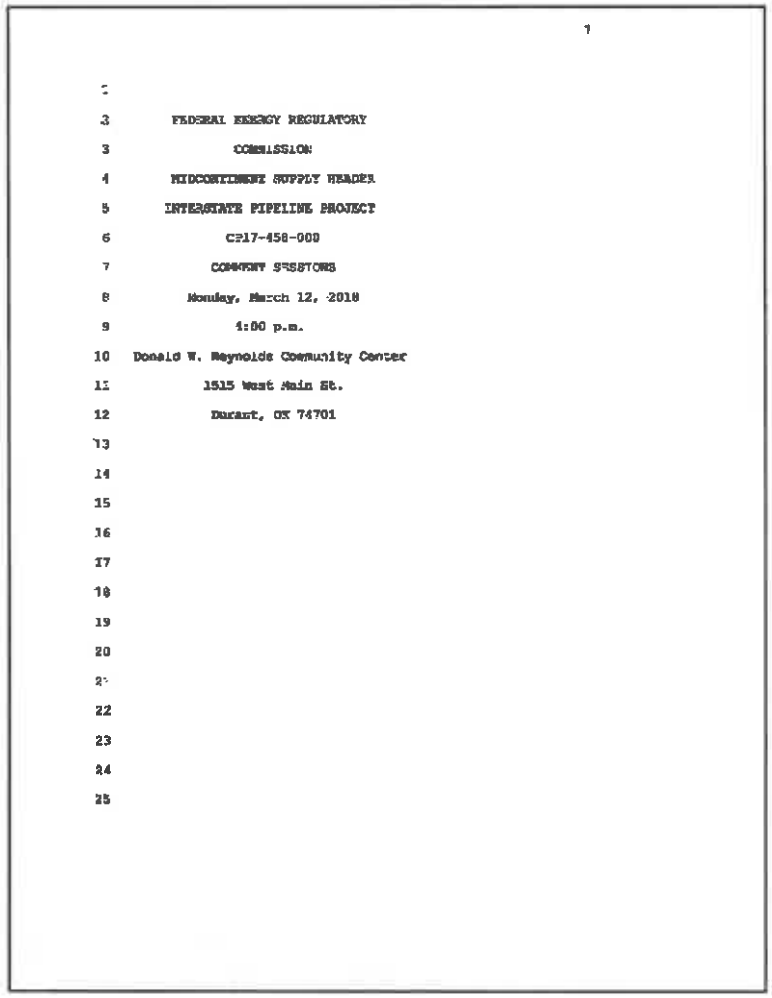
Midship Pipeline Company, LLC
Midcontinent Supply Header Interstate Pipeline Project

Responses to Comments on the Draft Environmental Impact Statement

INDEX

COMMENT SESSIONS (CS)

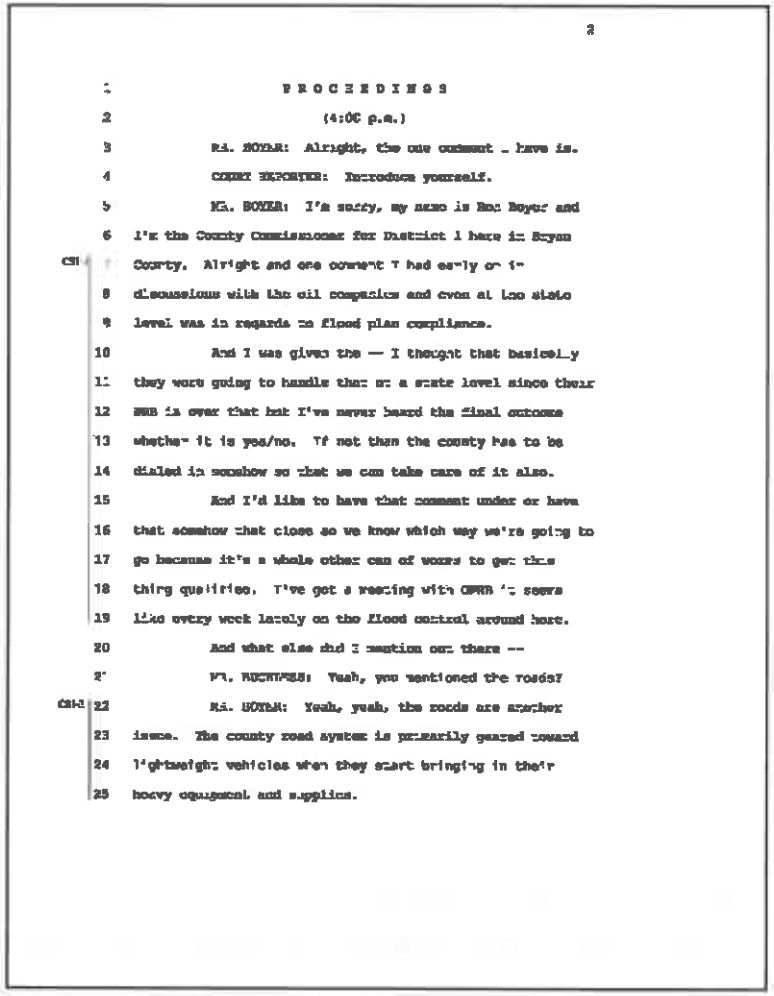
CS1 – Durant, Oklahoma Comment Session, March 12, 2018



1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER
INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Monday, March 12, 2018
4:00 p.m.
Donald W. Reynolds Community Center
1515 West Main St.
Durant, OK 74701

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)



2

PROCEEDINGS

(4:00 p.m.)

MS. BOYER: Alright, the one comment I have is.

COURT REPORTER: Introduce yourself.

MS. BOYER: I'm sorry, my name is Ms. Boyer and I'm the County Commissioner for District 1 here in Bryan County. Alright and one comment I had early on in discussions with the oil companies and even at the state level was in regards to flood plan compliance.

CS1-1

And I was given the — I thought that basically they were going to handle that at a state level since their NOB is over that but I've never heard the final outcome whether it is yes/no. If not then the county has to be dialed in somehow so that we can take care of it also.

And I'd like to have that comment under or have that somehow that close so we know which way we're going to go because it's a whole other can of worms to get this thing qualified. I've got a meeting with OWRB in seven like every week lately on the flood control around here.

And what else did I mention out there --

MR. ROCHTESS: Yeah, you mentioned the roads?

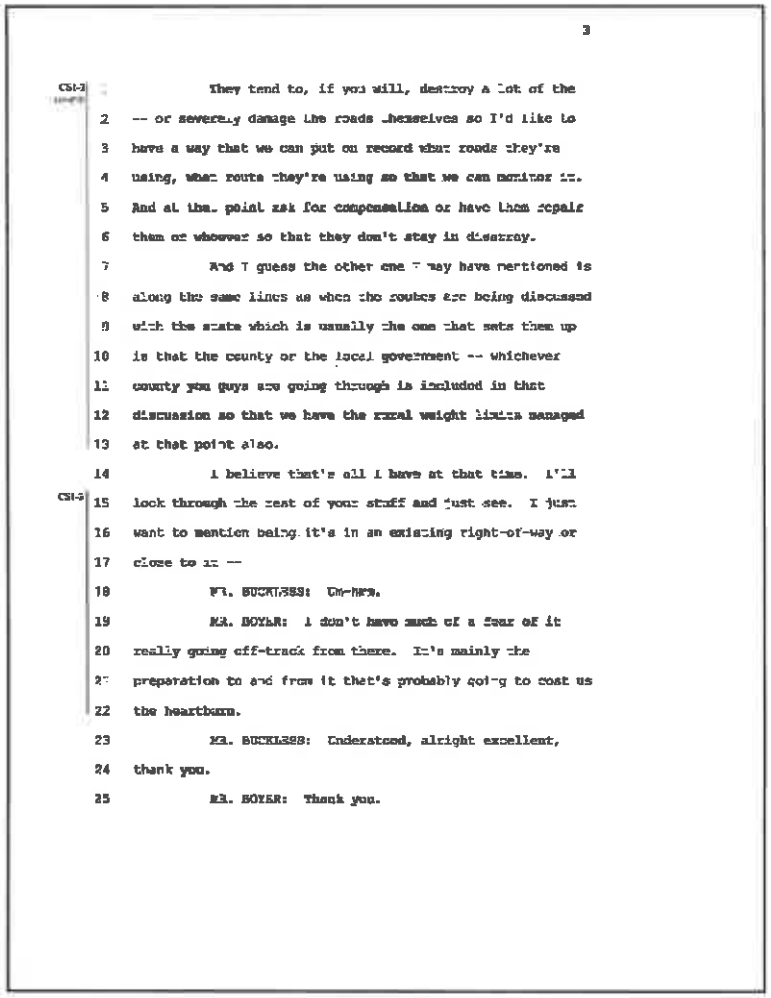
CS1-2

MS. BOYER: Yeah, yeah, the roads are another issue. The county road system is primarily geared toward lightweight vehicles when they start bringing in their heavy equipment and supplies.

CS1-1 Midship Pipeline Company, LLC (Midship Pipeline) has indicated that it would apply to the Oklahoma Water Resources Board – Planning and Management Division for a Floodplain Development Permit for the Midcontinent Supply Header Interstate Pipeline Project (MIDSHIP Project) in the third quarter of 2018. It has also stated that it would apply to the various county/local floodplain management departments for local floodplain permits, as required, in the third quarter of 2018.

CS1-2 As described in section 4.9.5 of the final environmental impact statement (EIS), Midship Pipeline and its contractors would comply with load limits and other specifications for use of paved and unpaved public roads, including adhering to any applicable permit conditions. In the event that construction traffic causes damage to the roads, Midship Pipeline would make repairs in accordance with the requirements set forth by the landowner or appropriate jurisdictional agency.

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)

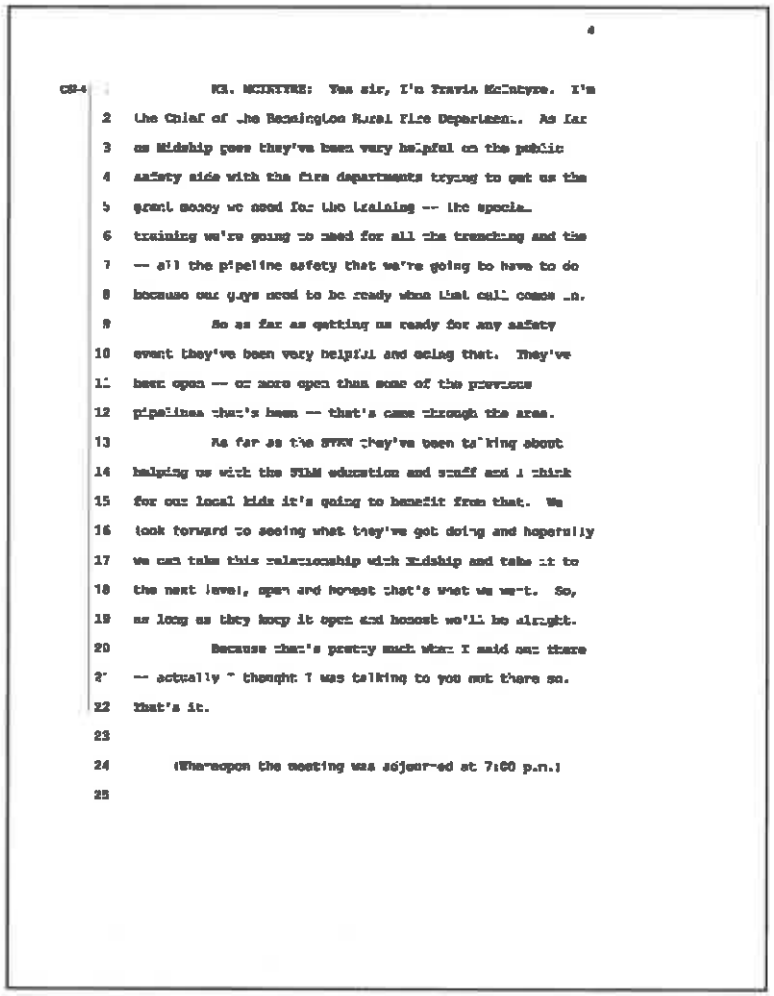


3

CS1-2 They tend to, if you will, destroy a lot of the
-- or severely damage the roads themselves so I'd like to
have a way that we can put on record what roads they're
using, what route they're using so that we can monitor it.
And at that point ask for compensation or have them repair
them or whoever so that they don't stay in disarray.
And I guess the other one I may have mentioned is
along the same lines as when the routes are being discussed
with the state which is usually the one that sets them up
is that the county or the local government -- whichever
county you guys are going through is included in that
discussion so that we have the rural weight limits managed
at that point also.
I believe that's all I have at that time. I'll
CS1-3 look through the rest of your stuff and just see. I just
want to mention being it's in an existing right-of-way or
close to it --
MR. BUCKLESS: Um-hmm.
MR. BOYER: I don't have much of a fear of it
really going off-track from there. It's mainly the
preparation to and from it that's probably going to cost us
the heartburn.
MR. BUCKLESS: Understood, alright excellent,
thank you.
MR. BOYER: Thank you.

CS1-3 Comment noted.

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)



CS1-4

MR. MCINTYRE: Yes sir, I'm Travis McIntyre. I'm the Chief of the Bennington Rural Fire Department. As far as Midship goes they've been very helpful on the public safety side with the fire departments trying to get us the grant money we need for the training -- the special training we're going to need for all the trenching and the -- all the pipeline safety that we're going to have to do because our guys need to be ready when that call comes in.

So as far as getting us ready for any safety event they've been very helpful and doing that. They've been open -- or more open than some of the previous pipelines that's been -- that's came through the area.

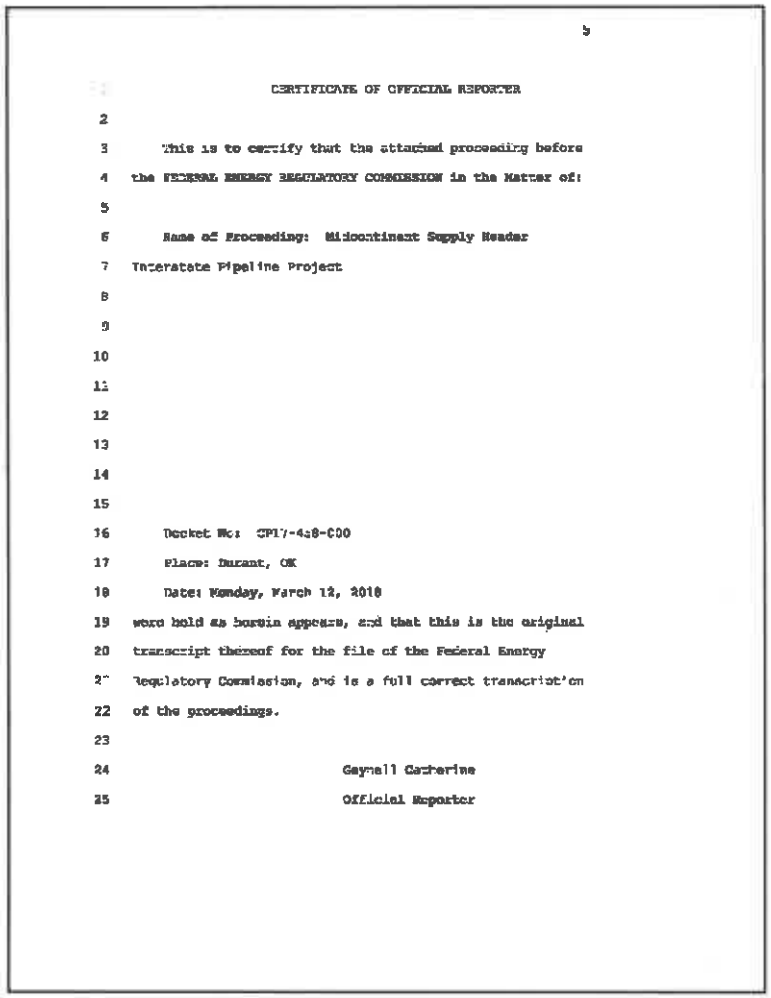
As far as the STEM they've been talking about helping us with the STEM education and stuff and I think for our local kids it's going to benefit from that. We look forward to seeing what they've got doing and hopefully we can take this relationship with Midship and take it to the next level, open and honest that's what we want. So, as long as they keep it open and honest we'll be alright.

Because that's pretty much what I said out there -- actually I thought I was talking to you out there so. That's it.

(Whereupon the meeting was adjourned at 7:00 p.m.)

CS1-4 Comments noted.

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)



5

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: Midcontinent Supply Header Interstate Pipeline Project

Docket No: CP17-488-000

Place: Durant, OK

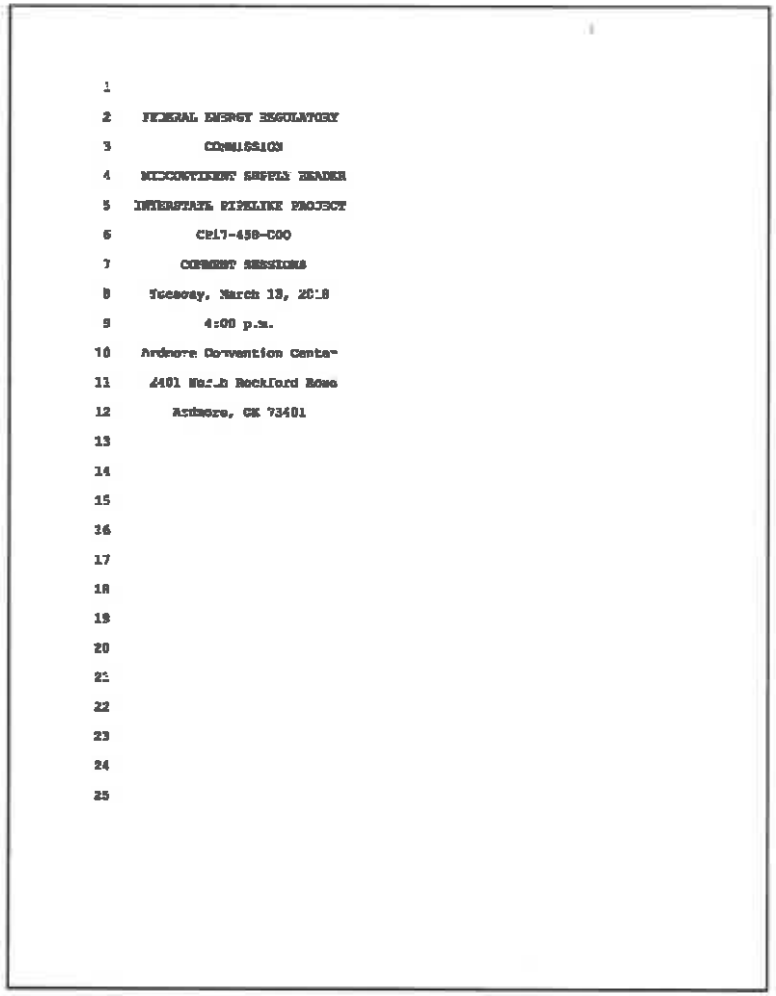
Date: Monday, March 12, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine

Official Reporter

CS2 – Ardmore, Oklahoma Comment Session, March 13, 2018



FEDERAL ENERGY REGULATORY

COMMISSION

MIDCONTINENT SUPPLY HEADER

INTERSTATE PIPELINE PROJECT

CP17-458-000

COMMENT SESSIONS

Tuesday, March 13, 2018

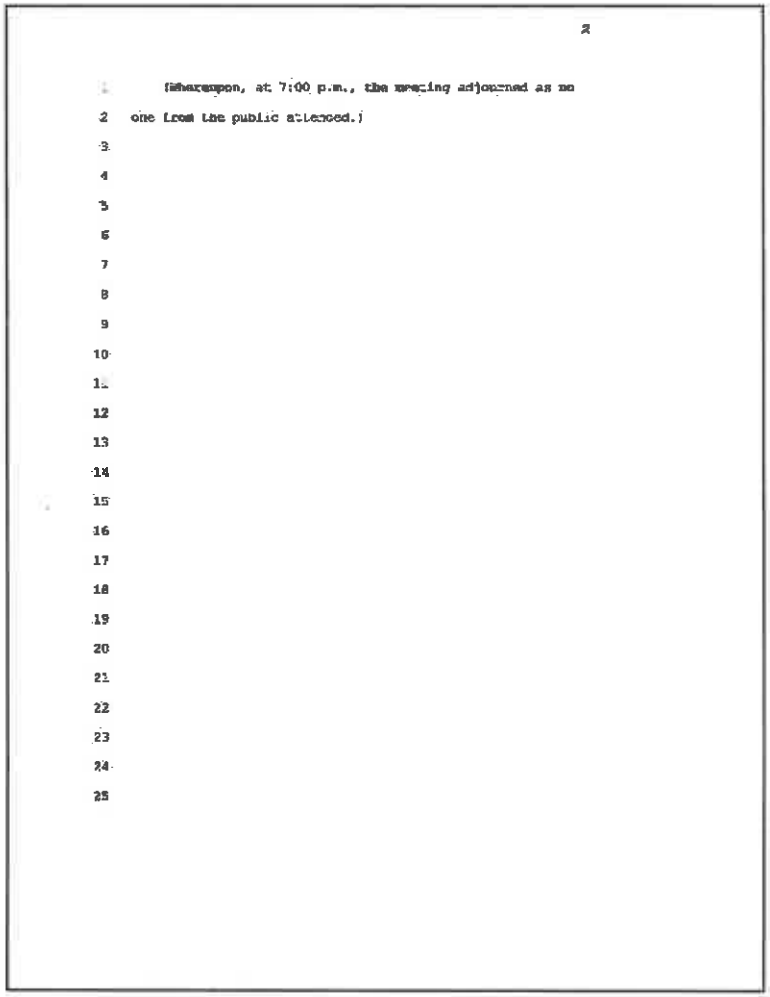
4:00 p.m.

Ardmore Convention Center

2401 North Rockford Road

Ardmore, OK 73401

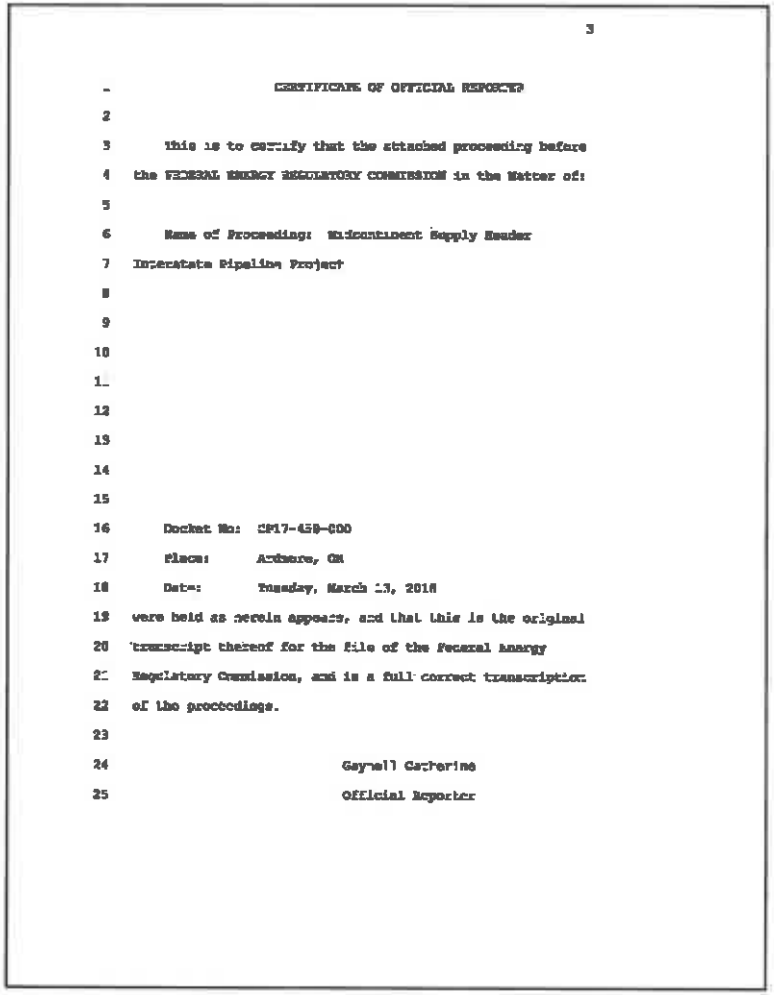
CS2 – Ardmore, Oklahoma Comment Session,
March 13, 2018 (cont'd)



2

(Whereupon, at 7:00 p.m., the meeting adjourned as no one from the public attended.)

CS2 – Ardmore, Oklahoma Comment Session, March 13, 2018 (cont'd)



3

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

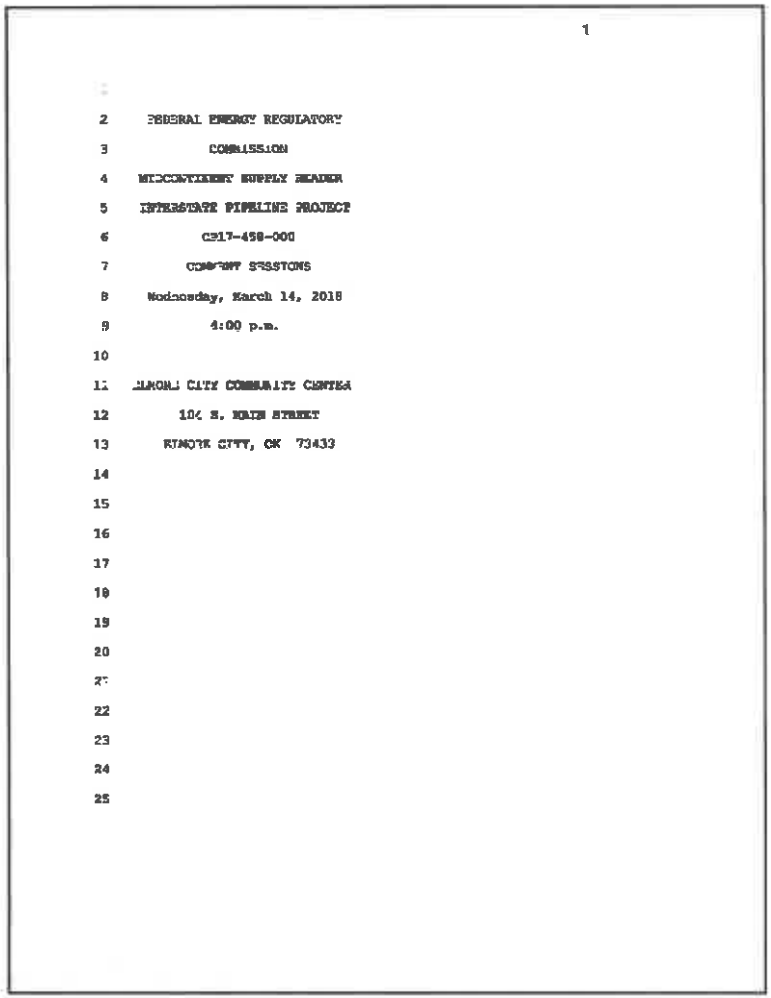
Name of Proceeding: Midcontinent Supply Header Interstate Pipeline Project

Docket No: CP17-458-000
Place: Ardmore, OK
Date: Tuesday, March 13, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine
Official Reporter

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018

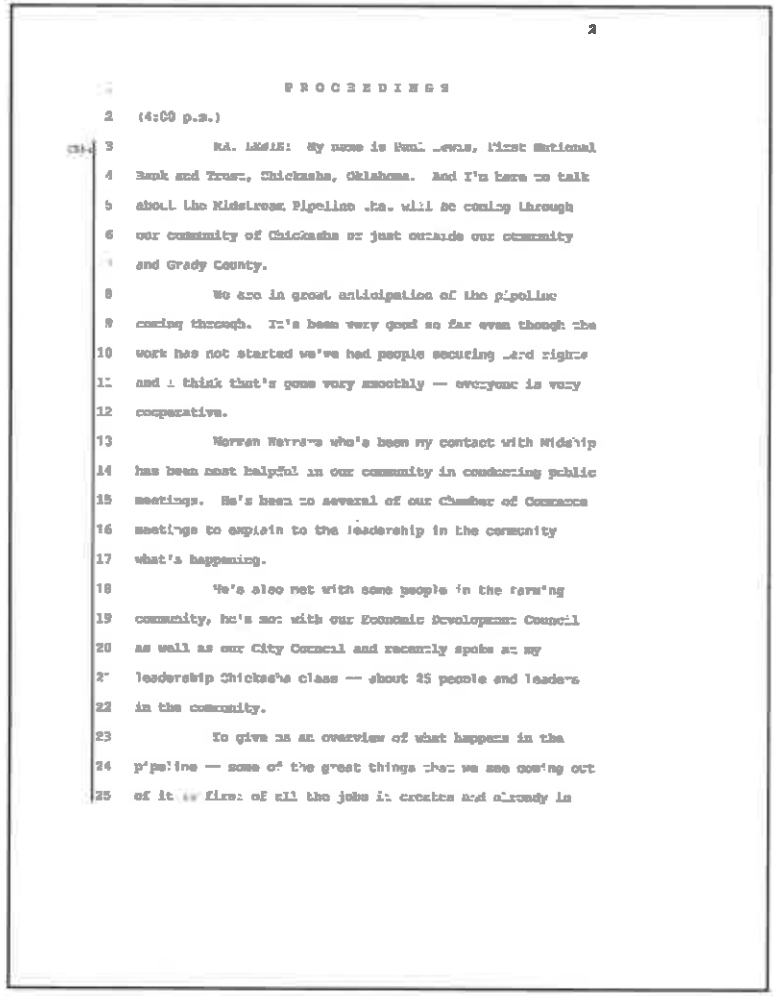


1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER
INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Wednesday, March 14, 2018
4:00 p.m.

ELMORE CITY COMMUNITY CENTER
104 E. MAIN STREET
ELMORE CITY, OK 73433

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)



2

P R O C E E D I N G S

(4:00 p.m.)

MR. [illegible]: My name is Paul [illegible], First National Bank and Trust, Chickasha, Oklahoma. And I'm here to talk about the Midstream Pipeline that will be coming through our community of Chickasha or just outside our community and Grady County.

We are in great anticipation of the pipeline coming through. It's been very good so far even though the work has not started we've had people securing land rights and I think that's gone very smoothly — everyone is very cooperative.

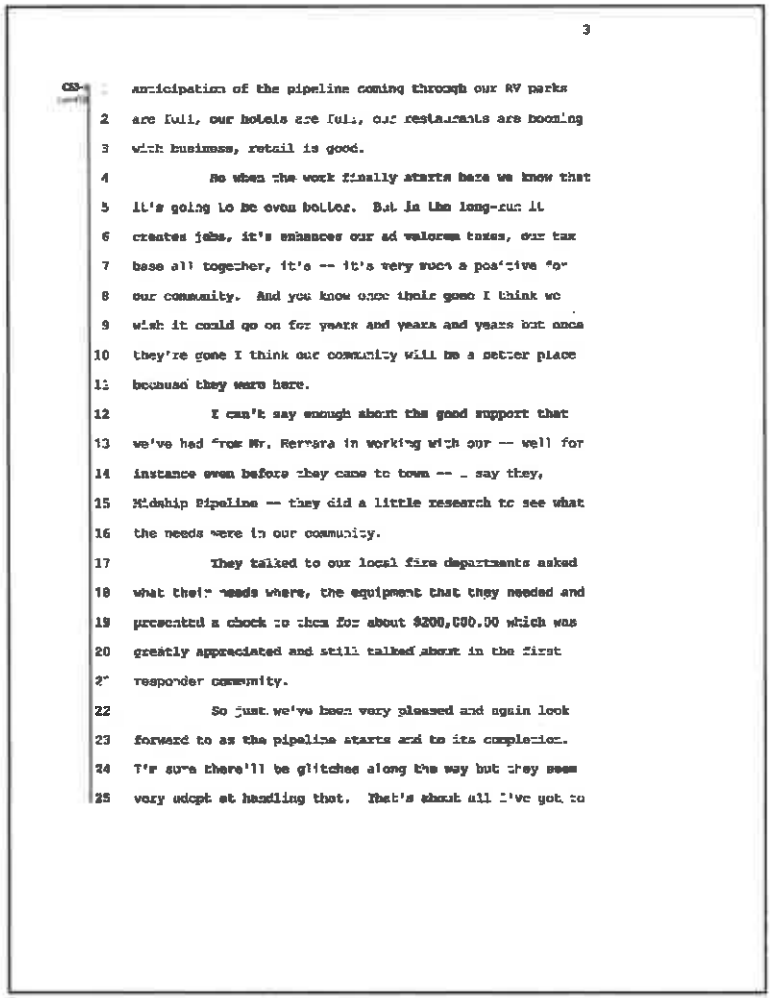
Warren Harris who's been my contact with Midship has been most helpful in our community in conducting public meetings. He's been to several of our Chamber of Commerce meetings to explain to the leadership in the community what's happening.

He's also met with some people in the farming community, he's met with our Economic Development Council as well as our City Council and recently spoke at my leadership Chickasha class — about 25 people and leaders in the community.

To give us an overview of what happens in the pipeline — some of the great things that we see coming out of it is first of all the jobs it creates and already in

CS3-1 Comments noted.

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)



CS3-1

anticipation of the pipeline coming through our RV parks are full, our hotels are full, our restaurants are booming with business, retail is good.

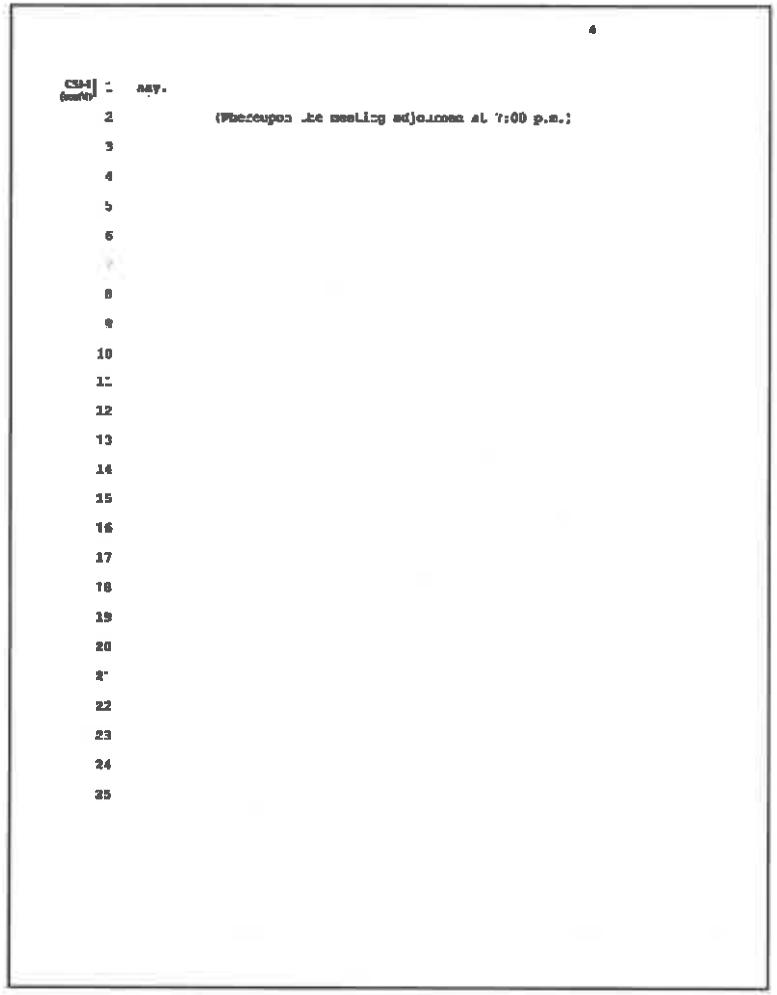
So when the work finally starts here we know that it's going to be even better. But in the long-run it creates jobs, it's enhances our ad valorem taxes, our tax base all together, it's -- it's very much a positive for our community. And you know once their gone I think we wish it could go on for years and years and years but once they're gone I think our community will be a better place because they were here.

I can't say enough about the good support that we've had from Mr. Herrera in working with our -- well for instance even before they came to town -- I say they, Midship Pipeline -- they did a little research to see what the needs were in our community.

They talked to our local fire departments asked what their needs where, the equipment that they needed and presented a check to them for about $200,000.00 which was greatly appreciated and still talked about in the first responder community.

So just we've been very pleased and again look forward to as the pipeline starts and to its completion. I'm sure there'll be glitches along the way but they seem very adept at handling that. That's about all I've got to

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)



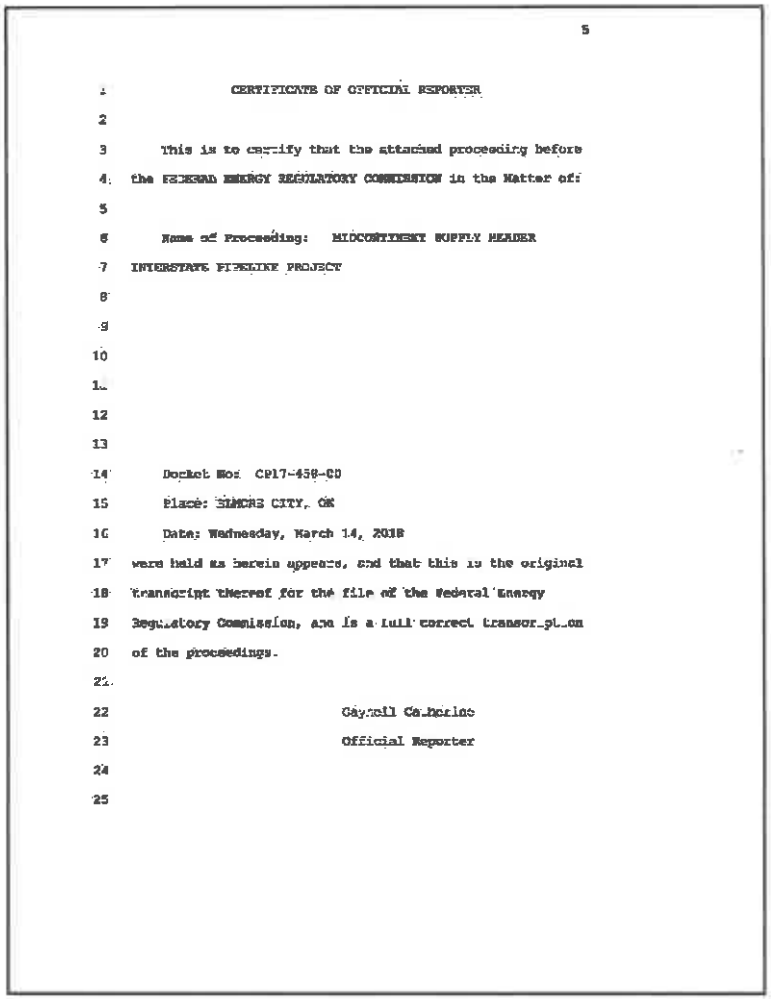
4

CS3 (cont'd)

say.

(Thereupon the meeting adjourned at 7:00 p.m.)

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)



5

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

Docket No: CP17-458-00

Place: ELMORE CITY, OK

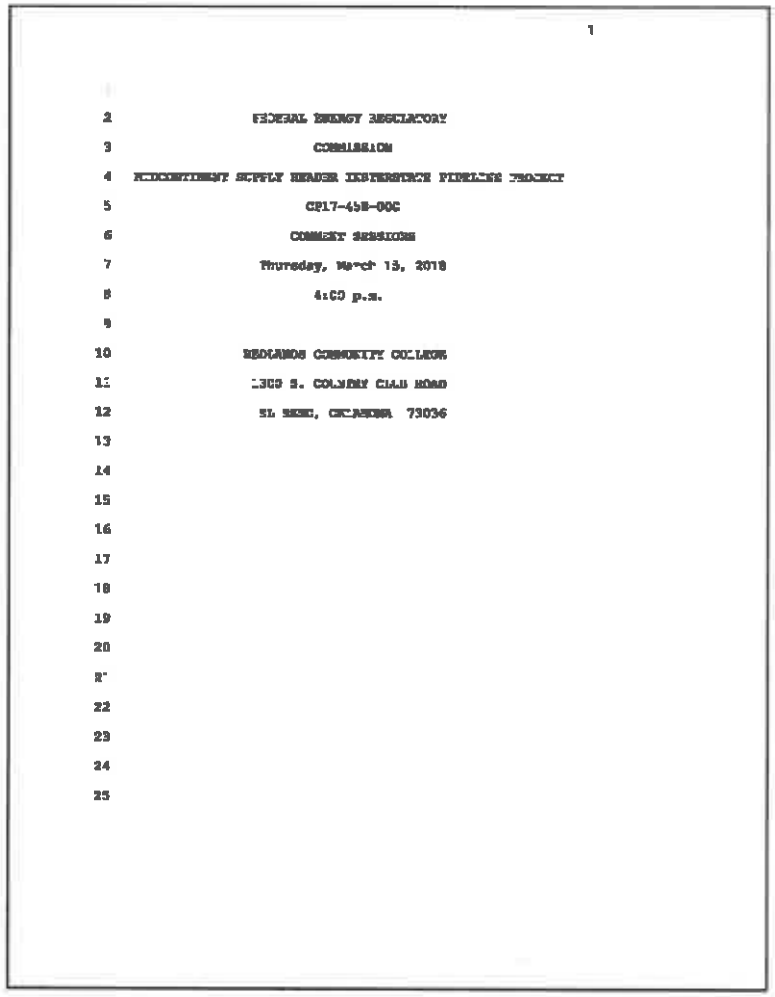
Date: Wednesday, March 14, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Caldwell

Official Reporter

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018

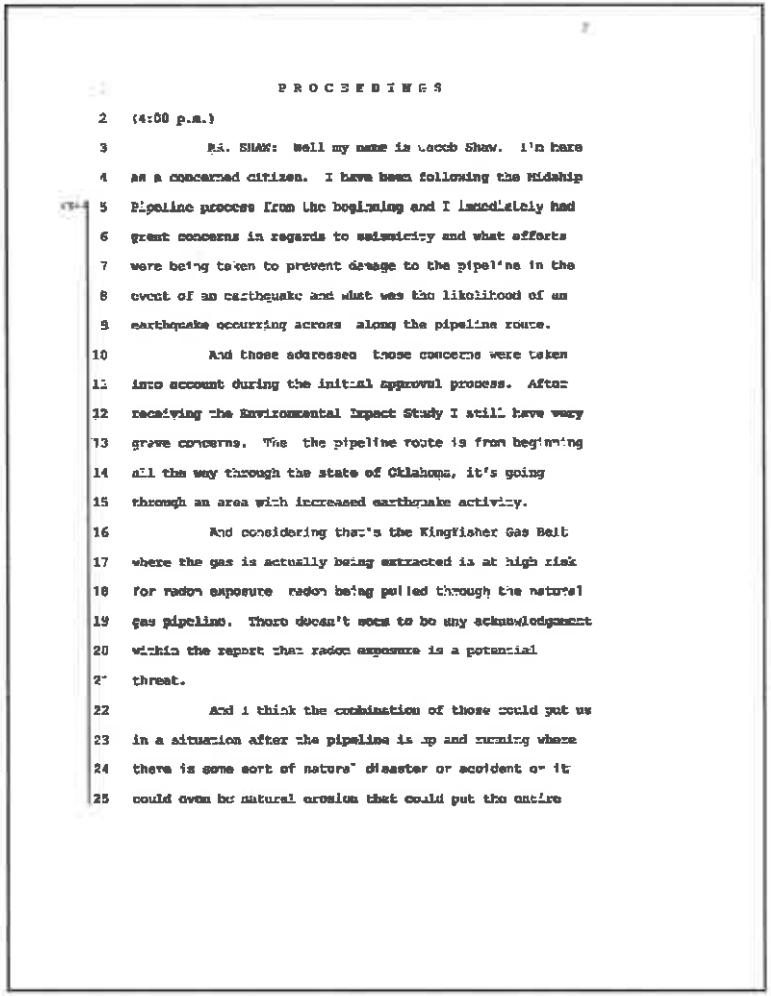


1

FEDERAL ENERGY REGULATORY
COMMISSION
ATLANTIC COAST PIPELINE, LLC AND DOMINION ENERGY TRANSMISSION, INC.
CP17-458-000
COMMENT SESSION
Thursday, March 15, 2018
4:00 p.m.

REDLANDS COMMUNITY COLLEGE
1300 S. COUNTRY CLUB ROAD
EL RENO, OKLAHOMA 73036

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



PROCEEDINGS

(4:00 p.m.)

MS. SHAW: Well my name is Jacob Shaw. I'm here as a concerned citizen. I have been following the Midship Pipeline process from the beginning and I immediately had great concerns in regards to seismicity and what efforts were being taken to prevent damage to the pipeline in the event of an earthquake and what was the likelihood of an earthquake occurring across along the pipeline route.

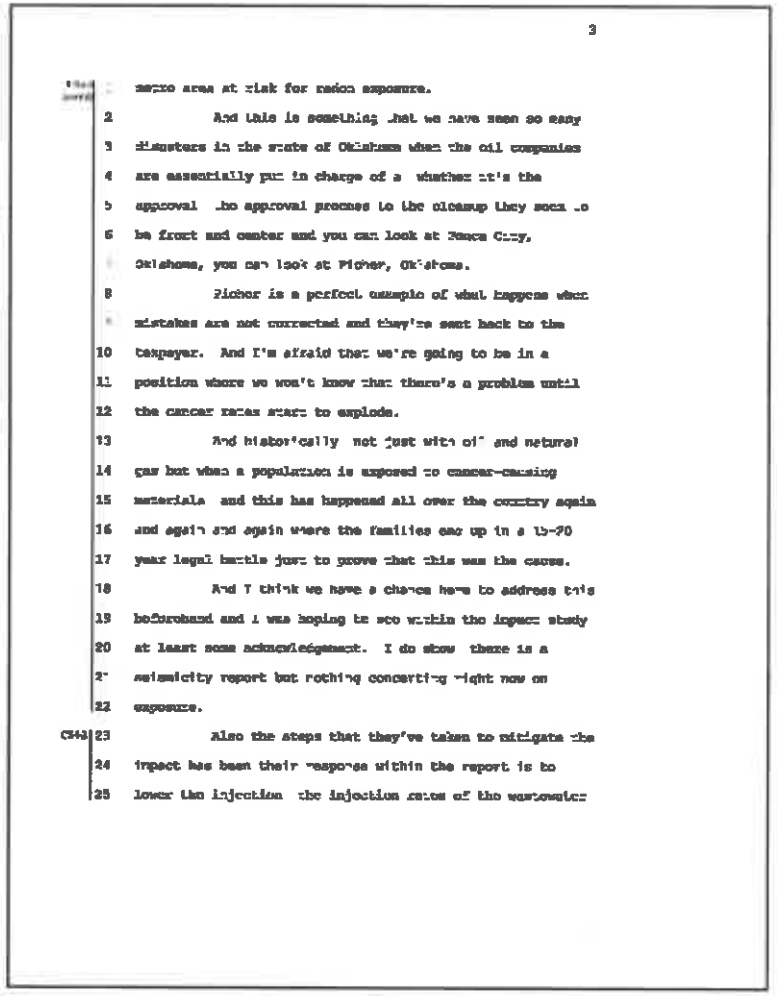
And those addressed those concerns were taken into account during the initial approval process. After receiving the Environmental Impact Study I still have very grave concerns. The the pipeline route is from beginning all the way through the state of Oklahoma, it's going through an area with increased earthquake activity.

And considering that's the KingFisher Gas Belt where the gas is actually being extracted is at high risk for radon exposure radon being pulled through the natural gas pipeline. There doesn't seem to be any acknowledgement within the report that radon exposure is a potential threat.

And I think the combination of those could put us in a situation after the pipeline is up and running where there is some sort of natural disaster or accident or it could even be natural erosion that could put the entire

CS4-1 As described in section 4.1.4.1 of the EIS, seismic events are not anticipated to affect a modern arc-welded pipeline. Section 4.11.1.4 of the EIS has been revised to include a description of the potential risks associated with exposure to radon gas.

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



3

...metro area at risk for radon exposure.

And this is something that we have seen so many disasters in the state of Oklahoma when the oil companies are essentially put in charge of a -- whether it's the approval -- the approval process to the cleanup they seem to be front and center and you can look at Ponca City, Oklahoma, you can look at Picher, Oklahoma.

Picher is a perfect example of what happens when mistakes are not corrected and they're sent back to the taxpayer. And I'm afraid that we're going to be in a position where we won't know that there's a problem until the cancer rates start to explode.

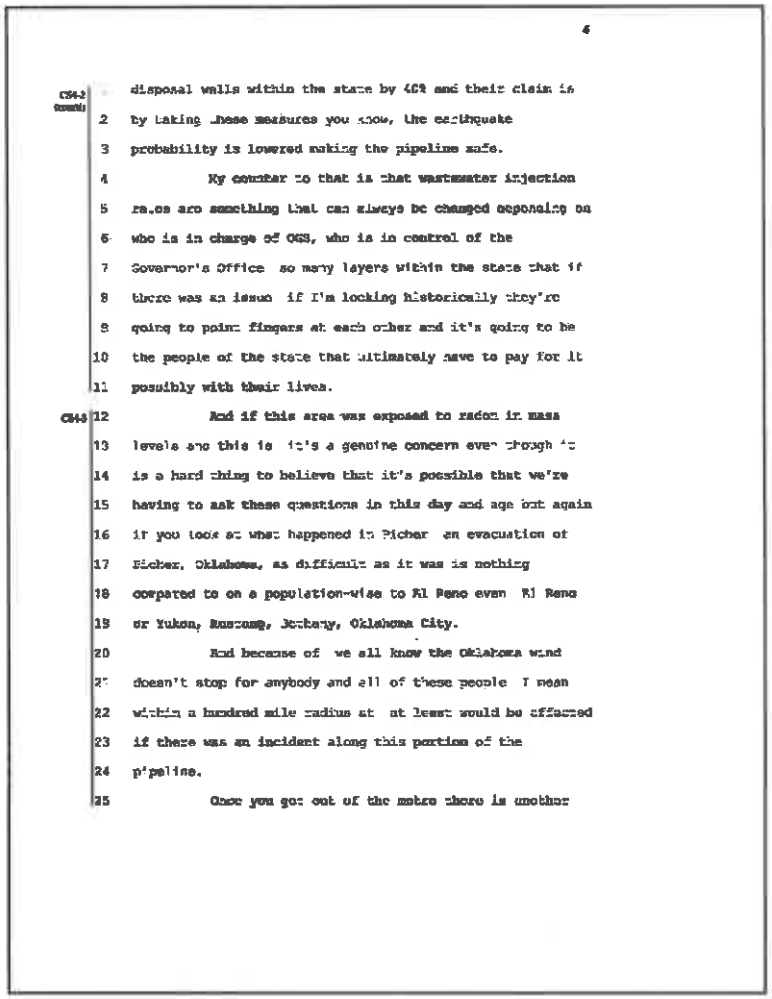
And historically -- not just with oil and natural gas but when a population is exposed to cancer-causing materials -- and this has happened all over the country again and again and again where the families end up in a 15-20 year legal battle just to prove that this was the cause.

And I think we have a chance here to address this beforehand and I was hoping to see within the impact study at least some acknowledgement. I do show there is a seismicity report but nothing concerning right now on exposure.

CS4-2 Also the steps that they've taken to mitigate the impact has been their response within the report is to lower the injection -- the injection rates of the wastewater

CS4-2 As described in section 4.1.4.1 of the EIS, the Oklahoma Corporation Commission, and not Midship Pipeline, has committed to reducing the wastewater disposal volume to 40 percent of the 2014 injection levels in the Area of Interest that overlaps the MIDSHIP Project and this is outside of the jurisdiction of the Federal Energy Regulatory Commission (FERC or Commission).

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



4

CS4-2 (cont'd)

disposal wells within the state by 40% and their claim is by taking these measures you know, the earthquake probability is lowered making the pipeline safe.

My counter to that is that wastewater injection rates are something that can always be changed depending on who is in charge of OGS, who is in control of the Governor's Office so many layers within the state that if there was an issue if I'm looking historically they're going to point fingers at each other and it's going to be the people of the state that ultimately have to pay for it possibly with their lives.

CS4-3 And if this area was exposed to radon in mass levels and this is it's a genuine concern even though it is a hard thing to believe that it's possible that we're having to ask these questions in this day and age but again if you look at what happened in Pichar an evacuation of Picher, Oklahoma, as difficult as it was is nothing compared to on a population-wise to El Reno even El Reno or Yukon, Mustang, Jenkins, Oklahoma City.

And because of we all know the Oklahoma wind doesn't stop for anybody and all of these people I mean within a hundred mile radius at at least would be affected if there was an incident along this portion of the p'peline.

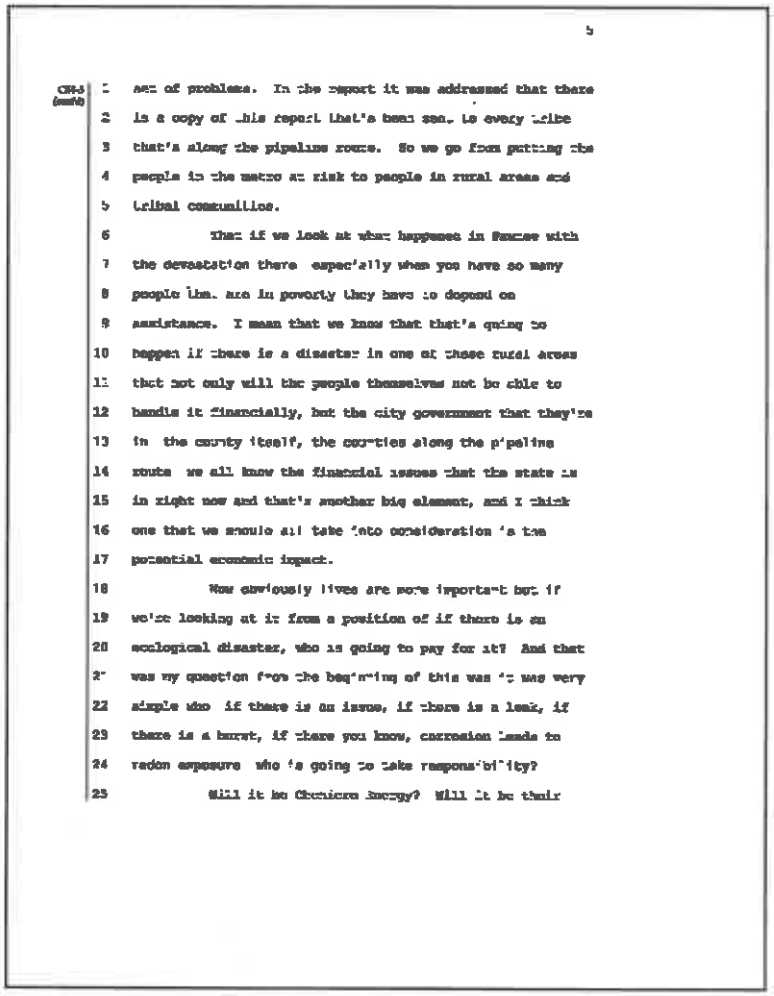
Once you get out of the metro there is another

CS4-3 See the response to comment CS4-1.

As described in section 4.12.1 of the EIS, the U.S. Department of Transportation would require Midship Pipeline to establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. In accordance with Title 49 of the Code of Federal Regulations Part 192.615, key elements of Midship Pipeline's emergency procedures would include but are not limited to the following:

- receiving, identifying, and classifying emergency events such as gas leakage, other releases, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property from actual or potential hazards; and
- implementing emergency shutdown of the system and the safe restoration of service.

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



CS4-5 (cont'd)

5

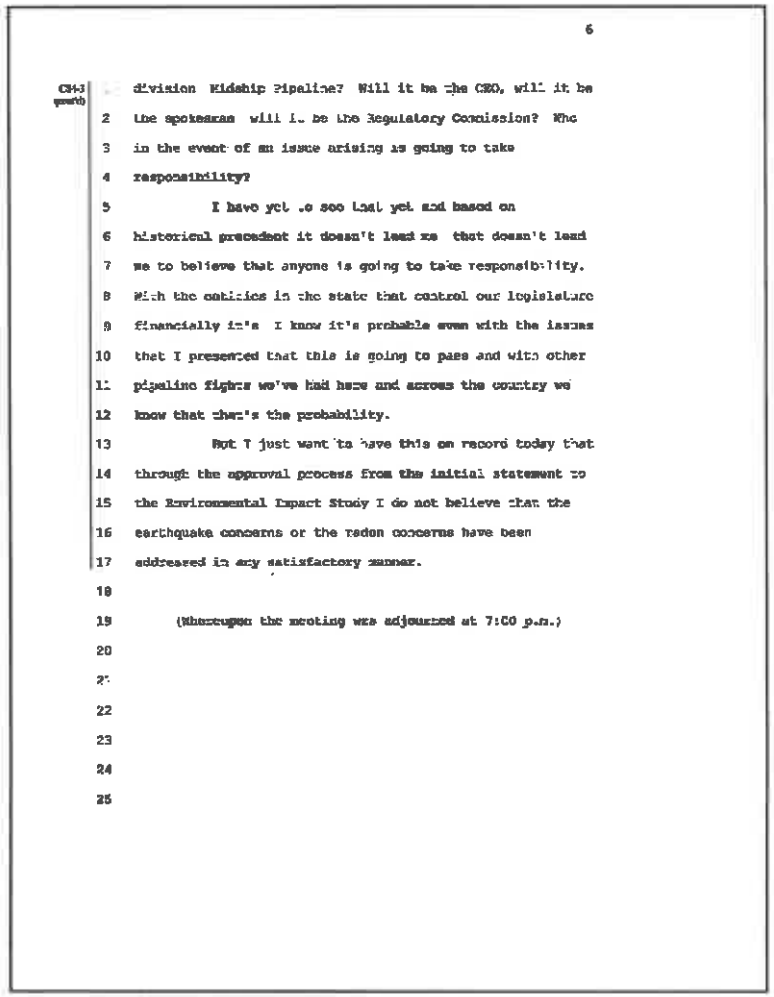
act of problems. In the report it was addressed that there is a copy of this report that's been sen. to every tribe that's along the pipeline routes. So we go from putting the people in the metro at risk to people in rural areas and tribal communities.

Then if we look at what happened in Kansas with the devastation there especially when you have so many people that are in poverty they have to depend on assistance. I mean that we know that that's going to happen if there is a disaster in one of these rural areas that not only will the people themselves not be able to handle it financially, but the city government that they're in the county itself, the counties along the pipeline route we all know the financial issues that the state is in right now and that's another big element, and I think one that we should all take into consideration is the potential economic impact.

Now obviously lives are more important but if we're looking at it from a position of if there is an ecological disaster, who is going to pay for it? And that was my question from the beginning of this was it was very simple who if there is an issue, if there is a leak, if there is a burst, if there you know, corrosion leads to radon exposure who is going to take responsibility?

Will it be Chesapeake Energy? Will it be their

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



6

CS4-3 (cont'd)

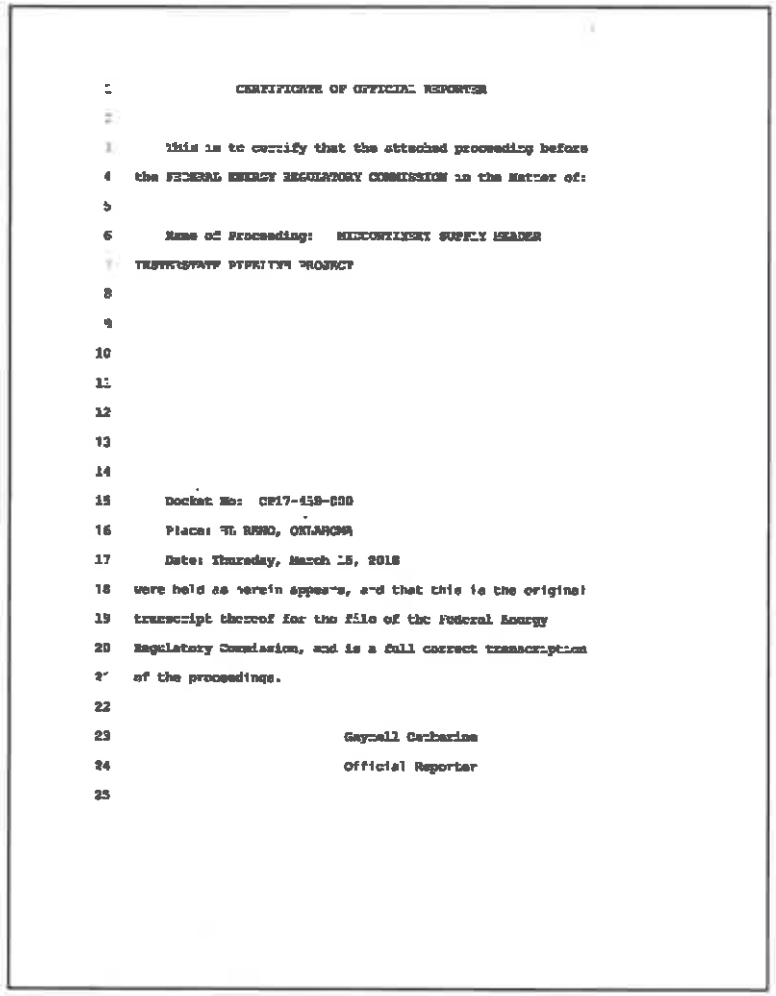
division Kidship Pipeline? Will it be the CEO, will it be the spokesman will it be the Regulatory Commission? Who in the event of an issue arising is going to take responsibility?

I have yet to see that yet and based on historical precedent it doesn't lead me that doesn't lead me to believe that anyone is going to take responsibility. With the entities in the state that control our legislature financially it's I know it's probable even with the issues that I presented that this is going to pass and with other pipeline fights we've had here and across the country we know that there's the probability.

But I just want to have this on record today that through the approval process from the initial statement to the Environmental Impact Study I do not believe that the earthquake concerns or the radon concerns have been addressed in any satisfactory manner.

(Whereupon the meeting was adjourned at 7:00 p.m.)

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)



CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: MIDCONTINENT SUPPLY HEADER TRANSMISSION PIPELINE PROJECT

Docket No: CP17-458-000

Place: EL RENO, OKLAHOMA

Date: Thursday, March 15, 2018

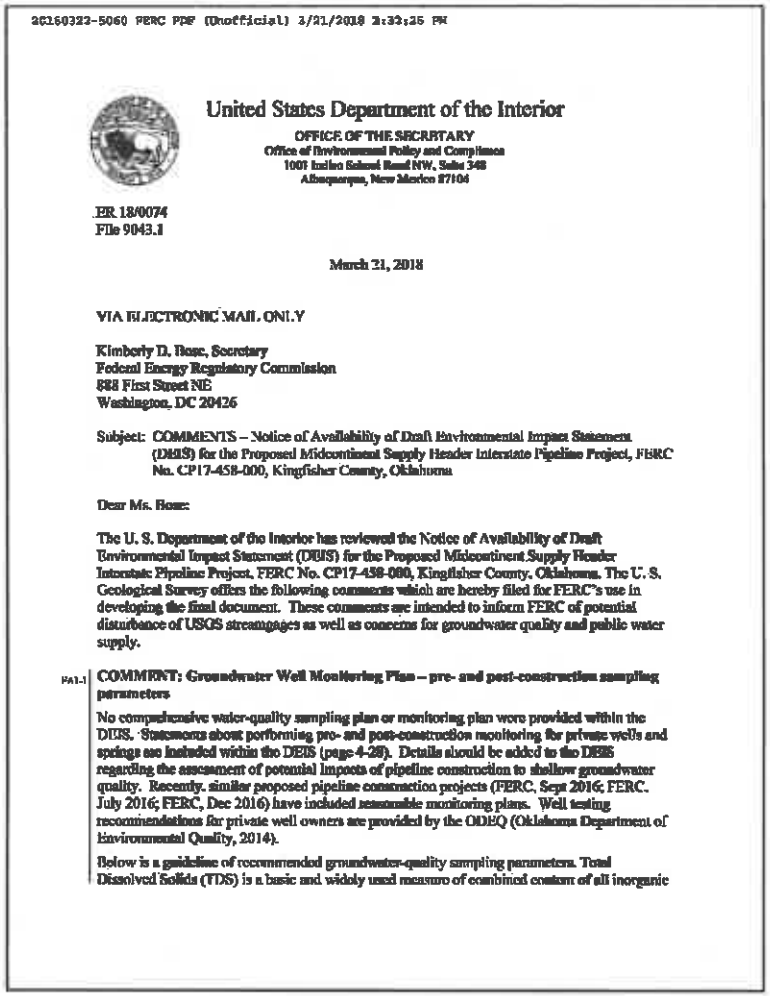
were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Carbarino

Official Reporter

FEDERAL AGENCIES (FA)

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance



20180322-5060 FERC PDF (Unofficial) 3/21/2018 2:33:25 PM

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER 18/0074
File 9043.1

March 21, 2018

VIA ELECTRONIC MAIL ONLY

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: COMMENTS – Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, FERC No. CP17-458-000, Kingfisher County, Oklahoma

Dear Ms. Bose:

The U. S. Department of the Interior has reviewed the Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, FERC No. CP17-458-000, Kingfisher County, Oklahoma. The U. S. Geological Survey offers the following comments which are hereby filed for FERC's use in developing the final document. These comments are intended to inform FERC of potential disturbance of USGS streamgages as well as concerns for groundwater quality and public water supply.

FA1-1 COMMENT: Groundwater Well Monitoring Plan – pre- and post-construction sampling parameters

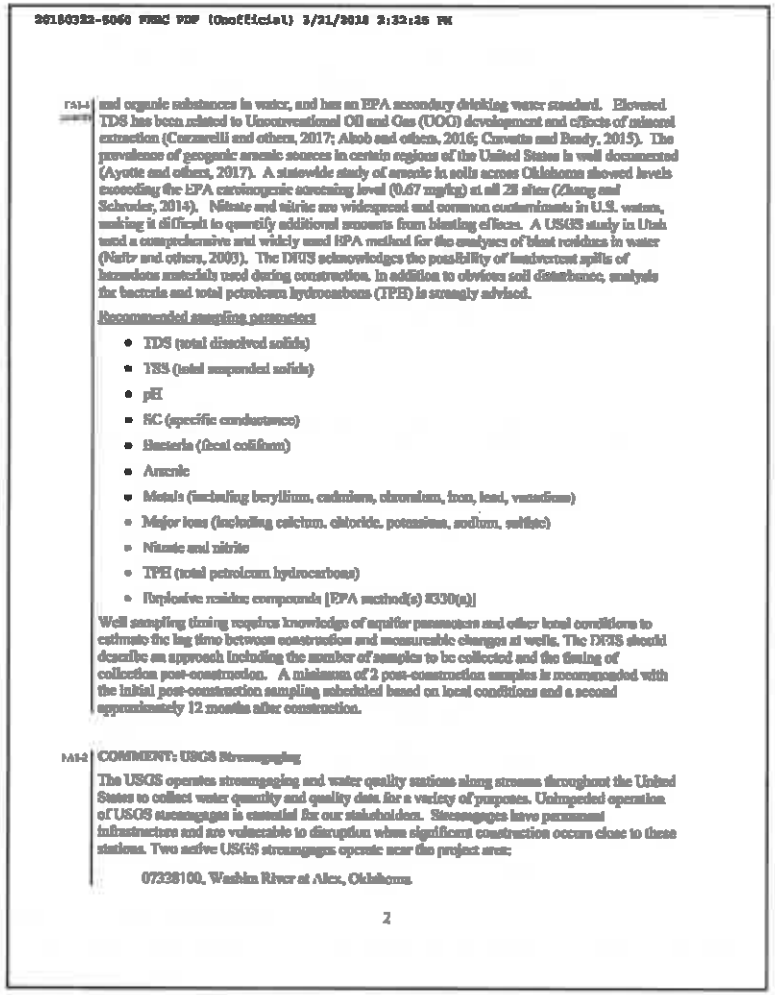
No comprehensive water-quality sampling plan or monitoring plan were provided within the DEIS. Statements about performing pre- and post-construction monitoring for private wells and springs are included within the DEIS (page 4-28). Details should be added to the DEIS regarding the assessment of potential impacts of pipeline construction to shallow groundwater quality. Recently, similar proposed pipeline construction projects (FERC, Sept 2016; FERC, July 2016; FERC, Dec 2016) have included reasonable monitoring plans. Well testing recommendations for private well owners are provided by the ODEQ (Oklahoma Department of Environmental Quality, 2014).

Below is a guideline of recommended groundwater-quality sampling parameters. Total Dissolved Solids (TDS) is a basic and widely used measure of combined content of all inorganic

FA1-1 To address the U.S. Department of the Interior's (DOI) concerns, we[1] are recommending in section 4.3.1.7 of the final EIS that, prior to construction, Midship Pipeline file a spring and well water quality sampling plan. The plan is to incorporate the recommended sampling parameters or provide sufficient explanation as to why a specific parameter would not provide information relevant to restoring wells and springs affected by construction of the MIDSHIP Project.

[1] "We," "us," and "our" refer to the environmental staff of the Federal Energy Regulatory Commission's Office of Energy Projects.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)



20180322-5060 FERC PDF (Unofficial) 3/21/2018 2:32:25 PM

FA1-1 and organic substances in water, and has an EPA secondary drinking water standard. Elevated TDS has been related to Unconventional Oil and Gas (UOG) development and effects of mineral extraction (Cozzarelli and others, 2017; Akob and others, 2016; Cravotta and Brady, 2015). The prevalence of geogenic arsenic sources in certain regions of the United States is well documented (Ayotte and others, 2017). A statewide study of arsenic in soils across Oklahoma showed levels exceeding the EPA carcinogenic screening level (0.67 mg/kg) at all 28 sites (Zhang and Schroder, 2014). Nitrate and nitrite are widespread and common contaminants in U.S. waters, making it difficult to quantify additional amounts from blasting efforts. A USGS study in Utah used a comprehensive and widely used EPA method for the analyses of blast residues in water (Naftz and others, 2005). The DEIS acknowledges the possibility of inadvertent spills of hazardous materials used during construction. In addition to obvious soil disturbance, analysis for bacteria and total petroleum hydrocarbons (TPH) is strongly advised.

Recommended sampling parameters

- TDS (total dissolved solids)
- TSS (total suspended solids)
- pH
- SC (specific conductance)
- Bacteria (fecal coliform)
- Arsenic
- Metals (including beryllium, cadmium, chromium, iron, lead, vanadium)
- Major ions (including calcium, chloride, potassium, sodium, sulfate)
- Nitrate and nitrite
- TPH (total petroleum hydrocarbons)
- Explosive residue compounds [EPA method(s) 8330(a)]

Well sampling timing requires knowledge of aquifer parameters and other local conditions to estimate the lag time between construction and measurable changes at wells. The DEIS should describe an approach including the number of samples to be collected and the timing of collection post-construction. A minimum of 2 post-construction samples is recommended with the initial post-construction sampling scheduled based on local conditions and a second approximately 12 months after construction.

FA1-2 COMMENT: USGS Streamgaging

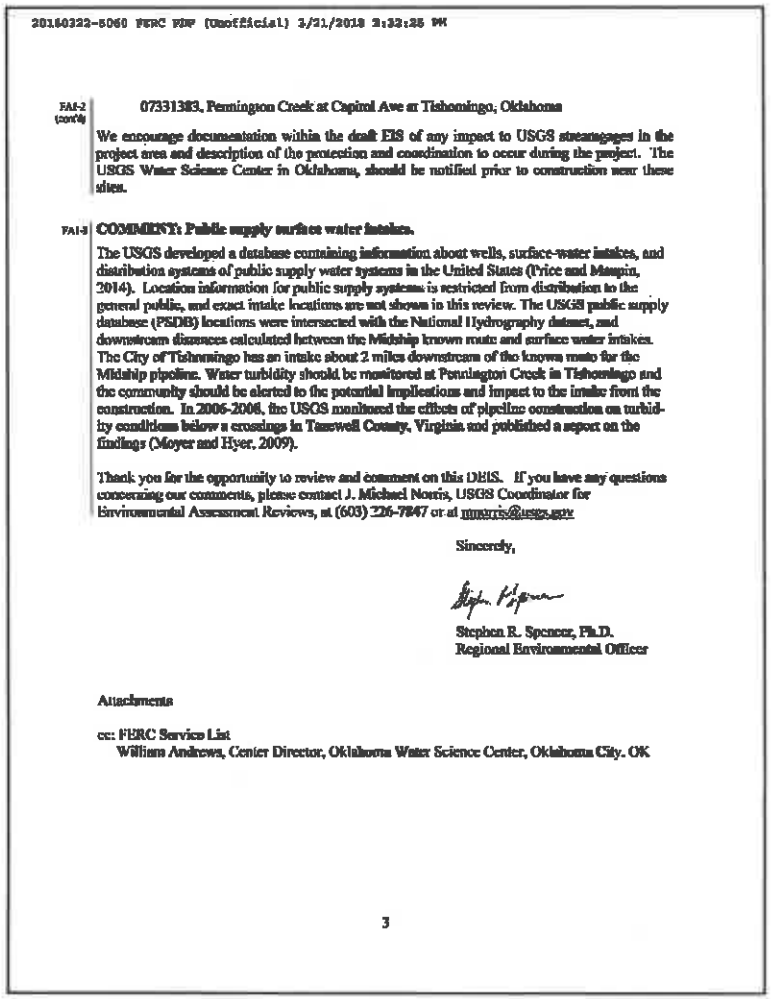
The USGS operates streamgaging and water quality stations along streams throughout the United States to collect water quantity and quality data for a variety of purposes. Unimpeded operation of USGS streamgages is essential for our stakeholders. Streamgages have permanent infrastructure and are vulnerable to disruption when significant construction occurs close to these stations. Two active USGS streamgages operate near the project area:

07328100, Washita River at Alex, Oklahoma

2

FA1-2 Streamgage 07328100 is over 2 miles upstream of the proposed Washita River horizontal directional drill (HDD) crossing; therefore, it would not likely be affected by construction or operation of the MIDSHIP Project. Streamgage 07331383 is over 2 miles downstream of the proposed Pennington Creek HDD; therefore, it would not likely be affected by construction or operation of the MIDSHIP Project.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)



20160322-5060 FERC PDF (Unofficial) 3/21/2016 2:32:25 PM

FA1-2 (cont'd)

07331383, Pennington Creek at Capitol Ave at Tishomingo, Oklahoma

We encourage documentation within the draft EIS of any impact to USGS streamgages in the project area and description of the protection and coordination to occur during the project. The USGS Water Science Center in Oklahoma, should be notified prior to construction near these sites.

FA1-3

COMMENT: Public supply surface water intakes.

The USGS developed a database containing information about wells, surface-water intakes, and distribution systems of public supply water systems in the United States (Price and Maupin, 2014). Location information for public supply systems is restricted from distribution to the general public, and exact intake locations are not shown in this review. The USGS public supply database (PSDB) locations were intersected with the National Hydrography dataset, and downstream distances calculated between the Midship known route and surface water intakes. The City of Tishomingo has an intake about 2 miles downstream of the known route for the Midship pipeline. Water turbidity should be monitored at Pennington Creek in Tishomingo and the community should be alerted to the potential implications and impact to the intake from the construction. In 2006-2008, the USGS monitored the effects of pipeline construction on turbidity conditions below 4 crossings in Tazewell County, Virginia and published a report on the findings (Moyer and Hyer, 2009).

Thank you for the opportunity to review and comment on this DEIS. If you have any questions concerning our comments, please contact J. Michael Norris, USGS Coordinator for Environmental Assessment Reviews, at (603) 226-7847 or at mnorris@usgs.gov

Sincerely,

Stephen R. Spencer, Ph.D.
Regional Environmental Officer

Attachments

cc: FERC Service List
William Andrews, Center Director, Oklahoma Water Science Center, Oklahoma City, OK

3

FA1-3 As described in sections 4.3.2.2 and 4.3.2.6 of the EIS, the City of Tishomingo water supply is over 2 miles downstream of the proposed Pennington Creek HDD. Midship Pipeline will continue to coordinate with the City of Tishomingo regarding mitigation of potential impacts on the public water supply; however, the City of Tishomingo stated that the information provided by Midship Pipeline appeared to consider best environmental practices to protect the water intake.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

20180322-5060 FERC PDF (Unofficial) 3/21/2018 2:32:33 PM

REFERENCES:

Akob, D.M., Mumford, A., Orem, W.H., Engle, M.A., Klinges, J., Kent, D.B., and Cozzarelli, I.M., 2016, Wastewater disposal from unconventional oil and gas development degrades stream quality at a West Virginia injection facility: Environmental Science & Technology, v. 50, p. 5517-5525.

Ayotte, J.D., Medalie, L., Qi, S.L., Backer, L.C., and Nolan, B.T., 2017, Estimating the High-Arsenic Domestic-Well Population in the Conterminous United States: Environmental Science & Technology, v. 51, p. 12443-12454.

Barringer, J.L., Reilly, P.A., Eberl, D.D., Bunn, A.E., Benzel, J.L., Rosman, R., Hirst, B., Alebus, M., Cozzo, K., and Gordon, M., 2011a, Arsenic in sediments, groundwater, and stream water of a glaciomarine Coastal Plain terrain, New Jersey, USA—Chemical "fingerprints" for geogenic and anthropogenic sources: Applied Geochemistry, v. 26, p. 763–776.

Cozzarelli, I.M., Skalak, K., Kent, D.B., Engle, M.A., Benthem, A.J., Mumford, A., Haase, K.B., Farag, A.M., Harper, D., Nagel, S.C., Iwanowicz, L.R., Orem, W.H., Akob, D.M., Jaeschke, J.B., Galloway, J.M., Kohler, M., Stanley, D.L., and Jolly, G.D., 2017, Environmental signatures and effects of an oil and gas wastewater spill in the Williston Basin, North Dakota: Science of the Total Environment, v. 579, p. 1781-1793.

Cravotta, C.A., and Brady, K.B.C., 2015, Priority pollutants and associated constituents in untreated and treated discharges from coal mining or processing facilities in Pennsylvania, USA: Applied Geochemistry, v. 62, p. 108-130.

Environmental Protection Agency, 2018, Testing wells to safeguard your water: https://www.epa.gov/privatewells/protect-your-homes-water#wellkitanchor

Environmental Protection Agency, 2018, SW-846 Test Method 8330A: Nitroaromatics and Nitroamines by High Performance Liquid Chromatography (HPLC). https://www.epa.gov/private-wells/protect-your-homes-water#wellkitanchor

Federal Energy Regulatory Commission, Sept 2016, Mountain Valley Project and Equitrans Expansion Project—Draft Environmental Impact Statement, Water Resources Identification and Testing Plan. Attachment DR3 Water Resources-1, p 1-9.

Federal Energy Regulatory Commission, July 2016, PennEast Pipeline Project—Draft Environmental Impact Statement, volume 1 (Appendix L): Washington, D.C., PennEast Pipeline Company, L.L.C., Docket No. CP15-558-000, FERC/EIS 0271D, 1176 p. [Also available at https://www.ferc.gov/industries/gas/enviro/eis/2016/07-22-16-eis.asp]

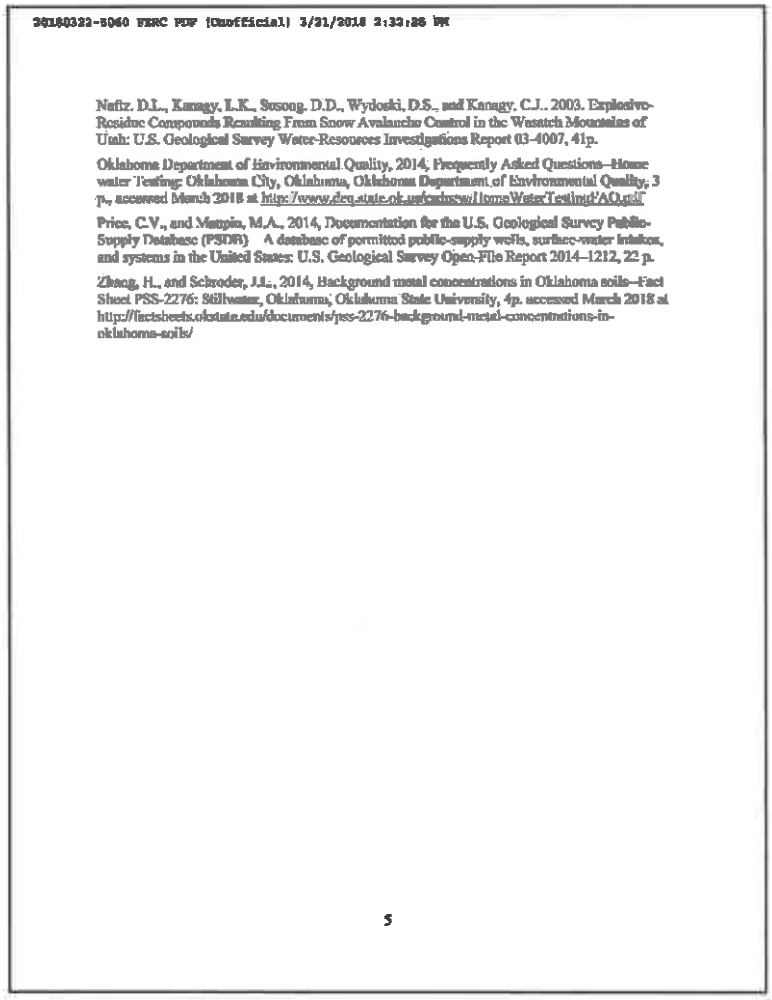
Federal Energy Regulatory Commission, Dec 2016, Atlantic Coast Pipeline and Supply Header Project, DEIS. Docket Nos. CP15-554-000, CP15-554-001, and CP15-555-000; FERC/EIS-0274D. 742p.

Heath, R.H., 1983, Basic ground-water hydrology: U.S. Geological Survey Water Supply Paper 2220, 86 p.

Moyer, D.L., and Hyer, K.E., 2009, Continuous turbidity monitoring in the Indian Creek watershed, Tazewell County, Virginia, 2006–08: U.S. Geological Survey Scientific Investigations Report 2009–5085, 42 p.

4

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)



20180322-5060 FERC PDF (Unofficial) 3/21/2018 2:33:26 PM

Naftz, D.L., Kanagy, L.K., Susong, D.D., Wydoski, D.S., and Kanagy, C.J., 2003, Explosive-Residue Compounds Resulting From Snow Avalanche Control in the Wasatch Mountains of Utah: U.S. Geological Survey Water-Resources Investigations Report 03-4007, 41p.

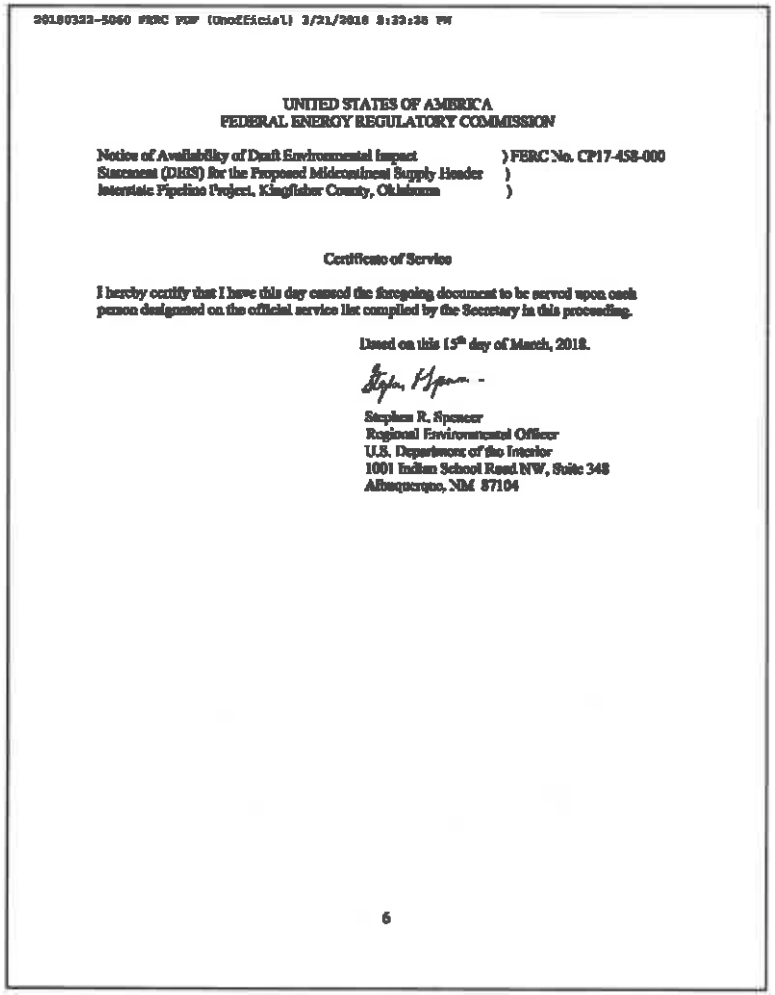
Oklahoma Department of Environmental Quality, 2014, Frequently Asked Questions–Home water Testing: Oklahoma City, Oklahoma, Oklahoma Department of Environmental Quality, 3 p., accessed March 2018 at http://www.deq.state.ok.us/factsnew/HomeWaterTesting#FAQ.pdf

Price, C.V., and Maupin, M.A., 2014, Documentation for the U.S. Geological Survey Public-Supply Database (PSDB): A database of permitted public-supply wells, surface-water intakes, and systems in the United States: U.S. Geological Survey Open-File Report 2014–1212, 22 p.

Zhang, H., and Schroder, J.L., 2014, Background metal concentrations in Oklahoma soils–Fact Sheet PSS-2276: Stillwater, Oklahoma, Oklahoma State University, 4p. accessed March 2018 at http://factsheets.okstate.edu/documents/pss-2276-background-metal-concentrations-in-oklahoma-soils/

5

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)



20180322-5060 FERC PDF (Unofficial) 3/21/2018 8:39:38 PM

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, Kingfisher County, Oklahoma) FERC No. CP17-458-000))

Certificate of Service

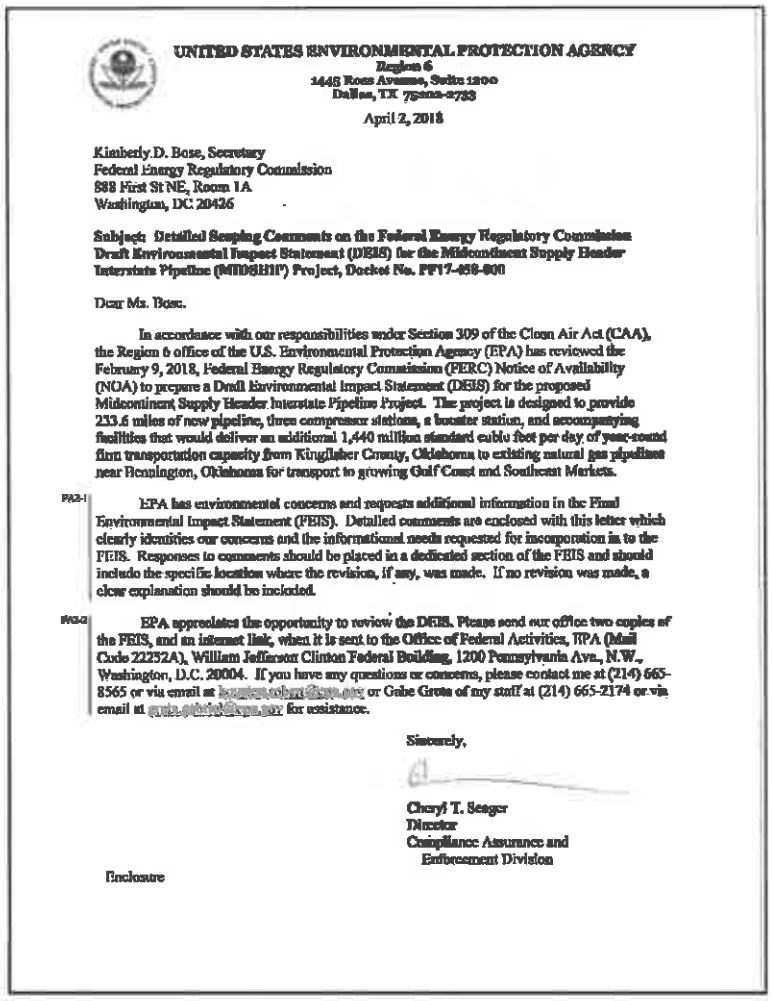
I hereby certify that I have this day caused the foregoing document to be served upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated on this 15th day of March, 2018.

Stephen R. Spencer
Regional Environmental Officer
U.S. Department of the Interior
1001 Indian School Road NW, Suite 348
Albuquerque, NM 87104

6

FA2 – U.S. Environmental Protection Agency, Region 6



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

April 2, 2018

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St NE, Room 1A
Washington, DC 20426

Subject: Detailed Scoping Comments on the Federal Energy Regulatory Commission Draft Environmental Impact Statement (DEIS) for the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. PF17-468-000

Dear Ms. Bose,

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the Region 6 office of the U.S. Environmental Protection Agency (EPA) has reviewed the February 9, 2018, Federal Energy Regulatory Commission (FERC) Notice of Availability (NOA) to prepare a Draft Environmental Impact Statement (DEIS) for the proposed Midcontinent Supply Header Interstate Pipeline Project. The project is designed to provide 233.6 miles of new pipeline, three compressor stations, a booster station, and accompanying facilities that would deliver an additional 1,440 million standard cubic feet per day of year-round firm transportation capacity from Kingfisher County, Oklahoma to existing natural gas pipelines near Bennington, Oklahoma for transport to growing Gulf Coast and Southeast Markets.

FA2-1 EPA has environmental concerns and requests additional information in the Final Environmental Impact Statement (FEIS). Detailed comments are enclosed with this letter which clearly identifies our concerns and the informational needs requested for incorporation in to the FEIS. Responses to comments should be placed in a dedicated section of the FEIS and should include the specific location where the revision, if any, was made. If no revision was made, a clear explanation should be included.

FA2-2 EPA appreciates the opportunity to review the DEIS. Please send our office two copies of the FEIS, and an internet link, when it is sent to the Office of Federal Activities, EPA (Mail Code 22252A), William Jefferson Clinton Federal Building, 1200 Pennsylvania Ave., N.W., Washington, D.C. 20004. If you have any questions or concerns, please contact me at (214) 665-8565 or via email at [redacted] or Gabe Gross of my staff at (214) 665-2174 or via email at [redacted] for assistance.

Sincerely,

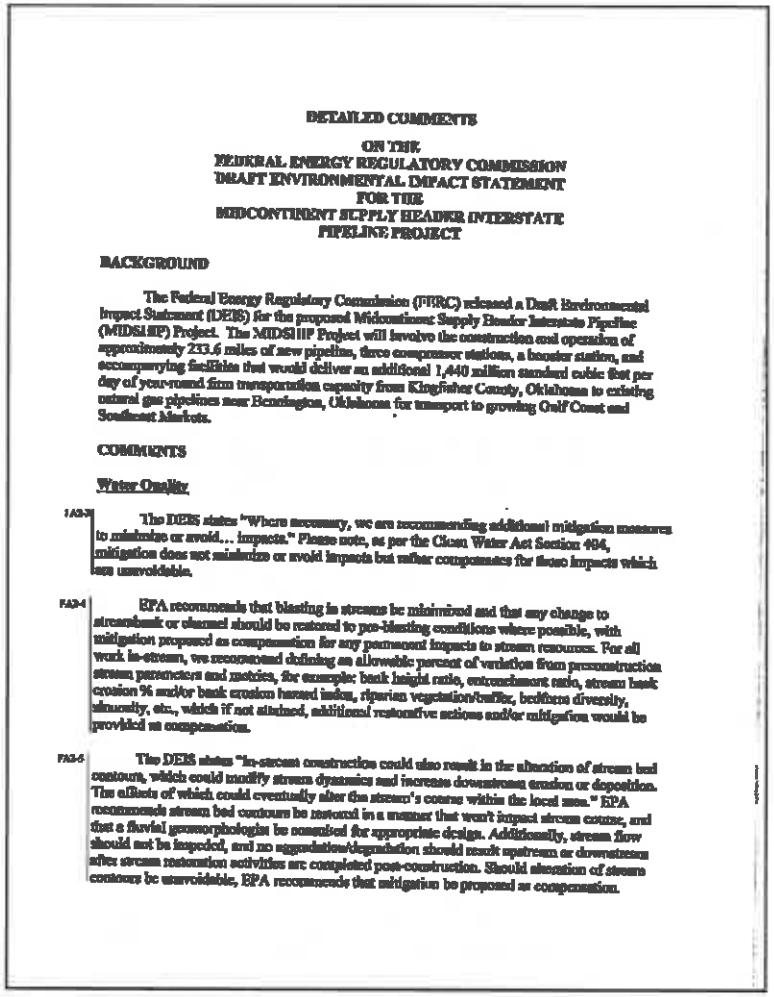
Cheryl T. Seager
Director
Compliance Assurance and Enforcement Division

Enclosure

FA2-1 This document contains our responses to the comments received on the draft EIS for the MIDSHIP Project and includes references to the specific EIS section in which each comment is addressed. Where no revision to the EIS is required, a clear explanation is provided.

FA2-2 We will send two copies of the final EIS, and an internet link to the document, to the U.S. Environmental Protection Agency (EPA), Office of Federal Activities.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)



DETAILED COMMENTS

ON THE
FEDERAL ENERGY REGULATORY COMMISSION
DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE
MIDCONTINENT SUPPLY HEADER INTERSTATE
PIPELINE PROJECT

BACKGROUND

The Federal Energy Regulatory Commission (FERC) released a Draft Environmental Impact Statement (DEIS) for the proposed Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project. The MIDSHIP Project will involve the construction and operation of approximately 233.6 miles of new pipeline, three compressor stations, a booster station, and accompanying facilities that would deliver an additional 1,440 million standard cubic feet per day of year-round firm transportation capacity from Kingfisher County, Oklahoma to existing natural gas pipelines near Bennington, Oklahoma for transport to growing Gulf Coast and Southeast Markets.

COMMENTS

Water Quality

FA2-3 The DEIS states "Where necessary, we are recommending additional mitigation measures to minimize or avoid... impacts." Please note, as per the Clean Water Act Section 404, mitigation does not minimize or avoid impacts but rather compensates for those impacts which are unavoidable.

FA2-4 EPA recommends that blasting in streams be minimized and that any change to streambank or channel should be restored to pre-blasting conditions where possible, with mitigation proposed as compensation for any permanent impacts to stream resources. For all work in-stream, we recommend defining an allowable percent of variation from preconstruction stream parameters and metrics, for example: bank height ratio, entrenchment ratio, stream bank erosion % and/or bank erosion hazard index, riparian vegetation/buffer, bedform diversity, sinuosity, etc., which if not attained, additional restorative actions and/or mitigation would be provided as compensation.

FA2-5 The DEIS states "In-stream construction could also result in the alteration of stream bed contours, which could modify stream dynamics and increase downstream erosion or deposition. The effects of which could eventually alter the stream's course within the local area." EPA recommends stream bed contours be restored in a manner that won't impact stream course, and that a fluvial geomorphologist be consulted for appropriate design. Additionally, stream flow should not be impeded, and no aggradation/degradation should result upstream or downstream after stream restoration activities are completed post-construction. Should alteration of stream contours be unavoidable, EPA recommends that mitigation be proposed as compensation.

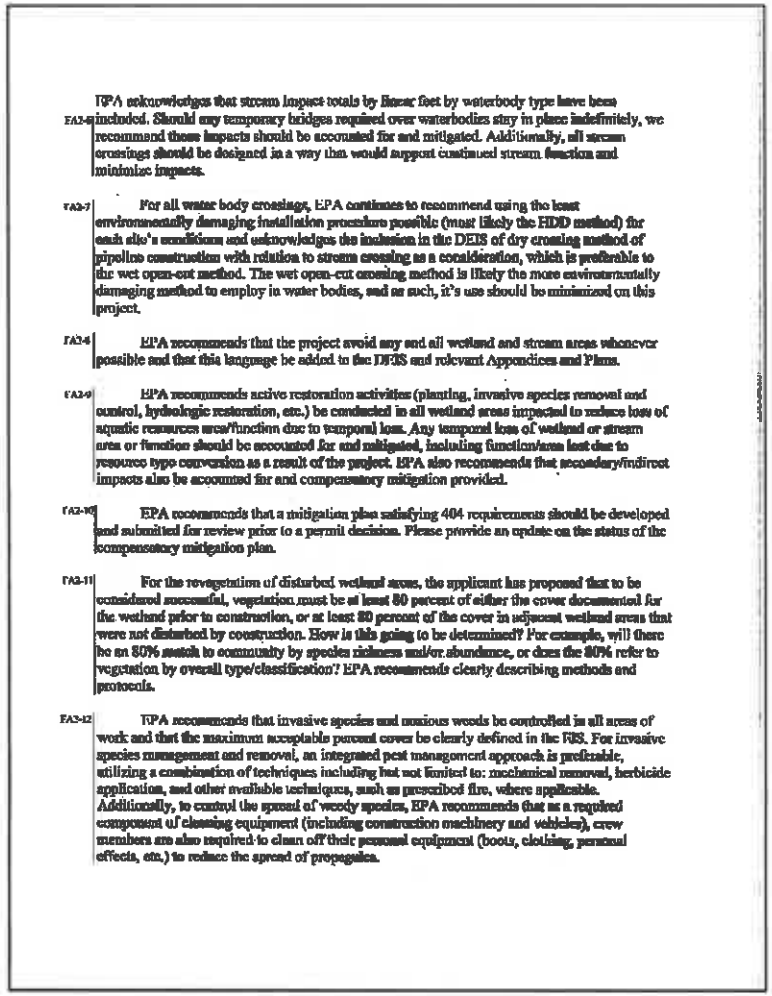
FA2-3 Comment noted.

FA2-4 As described in section 4.3.2.5 of the EIS, only 3 of the 344 waterbodies crossed by the proposed pipeline facilities (less than 1 percent) may require blasting or other special construction techniques due to the presence of shallow bedrock. As such, blasting in waterbodies would be minimal.

Section V.C.3 of the FERC's Wetland and Waterbody Construction and Mitigation Procedures (Procedures) requires restoration of streams to preconstruction contours or a stable angle of repose as approved by the Environmental Inspector, as well as post-construction monitoring until restoration is successful.

FA2-5 See the response to comment FA2-4. Additionally, section V.B.3.e of the Procedures requires that flow rates be maintained during construction to allow adequate protection of aquatic life and downstream use. The MIDSHIP Project would not result in permanent losses to streams. Temporary impacts would be mitigated through adherence to the Procedures and specialized construction methods as described in section 4.3.2.6 of the EIS.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)



EPA acknowledges that stream impact totals by linear feet by waterbody type have been included. Should any temporary bridges required over waterbodies stay in place indefinitely, we recommend these impacts should be accounted for and mitigated. Additionally, all stream crossings should be designed in a way that would support continued stream function and minimize impacts.

FA2-6

FA2-7 For all water body crossings, EPA continues to recommend using the least environmentally damaging installation procedure possible (most likely the HDD method) for each site's conditions and acknowledges the inclusion in the DEIS of dry crossing method of pipeline construction with relation to stream crossing as a consideration, which is preferable to the wet open-cut method. The wet open-cut crossing method is likely the more environmentally damaging method to employ in water bodies, and as such, it's use should be minimized on this project.

FA2-8 EPA recommends that the project avoid any and all wetland and stream areas whenever possible and that this language be added to the DEIS and relevant Appendices and Plans.

FA2-9 EPA recommends active restoration activities (planting, invasive species removal and control, hydrologic restoration, etc.) be conducted in all wetland areas impacted to reduce loss of aquatic resources area/function due to temporal loss. Any temporal loss of wetland or stream area or function should be accounted for and mitigated, including function/area lost due to resource type conversion as a result of the project. EPA also recommends that secondary/indirect impacts also be accounted for and compensatory mitigation provided.

FA2-10 EPA recommends that a mitigation plan satisfying 404 requirements should be developed and submitted for review prior to a permit decision. Please provide an update on the status of the compensatory mitigation plan.

FA2-11 For the revegetation of disturbed wetland areas, the applicant has proposed that to be considered successful, vegetation must be at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction. How is this going to be determined? For example, will there be an 80% match to community by species richness and/or abundance, or does the 80% refer to vegetation by overall type/classification? EPA recommends clearly describing methods and protocols.

FA2-12 EPA recommends that invasive species and noxious weeds be controlled in all areas of work and that the maximum acceptable percent cover be clearly defined in the EIS. For invasive species management and removal, an integrated pest management approach is preferable, utilizing a combination of techniques including but not limited to: mechanical removal, herbicide application, and other available techniques, such as prescribed fire, where applicable. Additionally, to control the spread of weedy species, EPA recommends that as a required component of cleaning equipment (including construction machinery and vehicles), crew members are also required to clean off their personal equipment (boots, clothing, personal effects, etc.) to reduce the spread of propagules.

FA2-6 Midship Pipeline would use existing bridges and access roads to cross waterbodies. No new permanent bridges are proposed. Should temporary bridges over waterbodies be proposed, our Procedures require bridge construction be conducted to allow unrestricted flow and prevent soil from entering the waterbody (section V.B.5).

FA2-7 Section 4.3.2.5 of the EIS describes how the Clean Water Act Section 404(b)(1) Guidelines require avoidance and minimization of impacts on waters of the United States. However, the use of the HDD method at every crossing is generally not practical, and is used only for sensitive waterbody crossings. A discussion relating to the impracticality of using the HDD method at every crossing is included in section 4.3.2.6 of the EIS. Additionally, in response to our recommendation in the draft EIS, Midship Pipeline has committed to using the dry crossing method at the 43 streams identified in appendix J, which would reduce impacts on waterbodies.

FA2-8 Avoidance of wetlands and waterbodies is determined during review of the pipeline under section 404 of the Clean Water Act. Clarification of this requirement is included in sections 4.3.2.5 and 4.4.6 of the EIS. In addition, Midship Pipeline has agreed to implement measures (e.g., reroutes, alternative crossing methods) to minimize impacts on wetlands and waterbodies in response to our recommendations in the draft EIS.

FA2-9 Section VI.C of the FERC's Procedures describes wetland restoration requirements, which includes, but is not limited to, consultation with appropriate federal or state agencies to develop a project-specific wetland restoration plan, and ensuring that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species and control the invasion and spread of invasive species and noxious weeds.

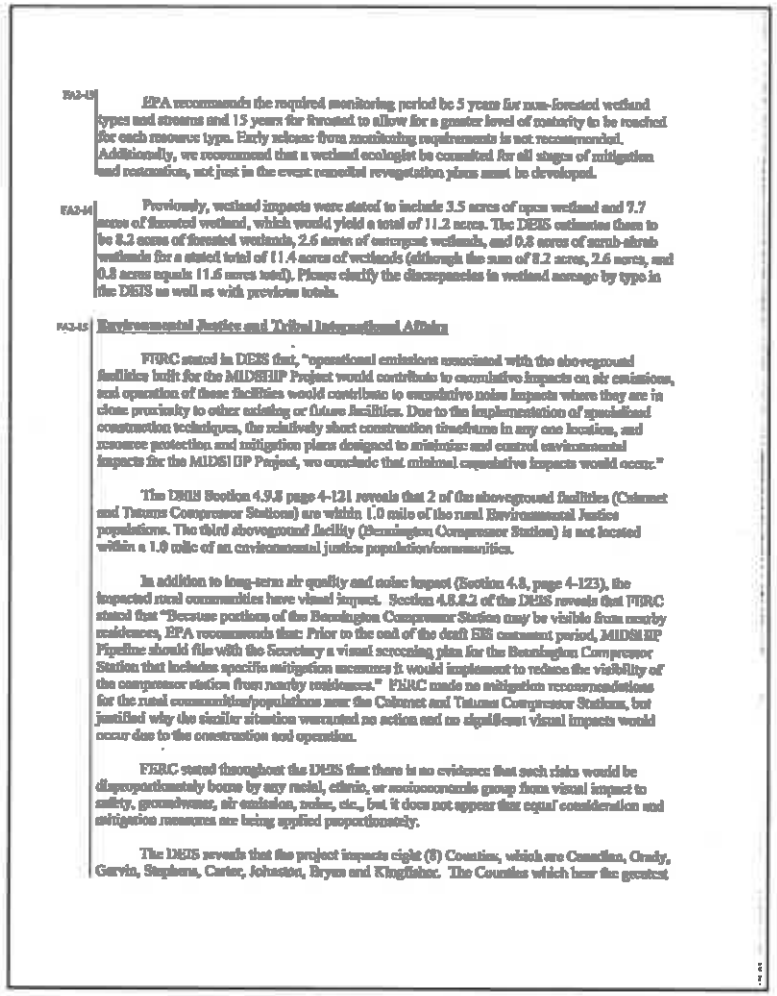
FA2-10 As described in section 4.4.6 of the EIS, the compensatory mitigation plan is part of the permitting process associated with section 404 of the Clean Water Act. It would be developed and submitted to the U.S. Army Corps of Engineers, and would be implemented in addition to the construction mitigation measures outlined in the FERC's Procedures and the measures described in the EIS.

FA2-11 Section VI.D.5 of the FERC's Procedures describes the criteria for determining successful wetland restoration, including that vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction. If natural rather than active revegetation was used, the plant species composition must be consistent with early successional wetland plant communities in the affected ecoregion. The U.S. Army Corps of Engineers may require additional monitoring parameters during its permitting process.

FA2-12 FERC would not require control of invasive species in locations that they were established prior to construction.

[Note: This response is continued on the next page.]

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)



FA2-12 (cont'd) EPA recommends the required monitoring period be 5 years for non-forested wetland types and streams and 15 years for forested to allow for a greater level of maturity to be reached for each resource type. Early release from monitoring requirements is not recommended. Additionally, we recommend that a wetland ecologist be consulted for all stages of mitigation and restoration, not just in the event remedial revegetation plans must be developed.

FA2-13 Previously, wetland impacts were stated to include 3.5 acres of open wetland and 7.7 acres of forested wetland, which would yield a total of 11.2 acres. The DEIS estimates them to be 8.2 acres of forested wetlands, 2.6 acres of emergent wetlands, and 0.8 acres of scrub-shrub wetlands for a stated total of 11.4 acres of wetlands (although the sum of 8.2 acres, 2.6 acres, and 0.8 acres equals 11.6 acres total). Please clarify the discrepancies in wetland acreage by type in the DEIS as well as with previous totals.

FA2-14 **Environmental Justice and Tribal Intergovernmental Affairs**

FERC stated in DEIS that, "operational emissions associated with the aboveground facilities built for the MIDSHIP Project would contribute to cumulative impacts on air emissions, and operation of these facilities would contribute to cumulative noise impacts where they are in close proximity to other existing or future facilities. Due to the implementation of specialized construction techniques, the relatively short construction timeframe in any one location, and resource protection and mitigation plans designed to minimize and control environmental impacts for the MIDSHIP Project, we conclude that minimal cumulative impacts would occur."

The DEIS Section 4.9.8 page 4-121 reveals that 2 of the aboveground facilities (Calumet and Tatums Compressor Stations) are within 1.0 mile of the rural Environmental Justice populations. The third aboveground facility (Bennington Compressor Station) is not located within a 1.0 mile of an environmental justice population/communities.

In addition to long-term air quality and noise impact (Section 4.8, page 4-123), the impacted rural communities have visual impact. Section 4.8.8.2 of the DEIS reveals that FERC stated that "Because portions of the Bennington Compressor Station may be visible from nearby residences, EPA recommends that: Prior to the end of the draft EIS comment period, MIDSHIP Pipeline should file with the Secretary a visual screening plan for the Bennington Compressor Station that includes specific mitigation measures it would implement to reduce the visibility of the compressor station from nearby residences." FERC made no mitigation recommendations for the rural communities/populations near the Calumet and Tatums Compressor Stations, but justified why the similar situation warranted no action and no significant visual impacts would occur due to the construction and operation.

FERC stated throughout the DEIS that there is no evidence that such risks would be disproportionately borne by any racial, ethnic, or socioeconomic group from visual impact to safety, groundwater, air emission, noise, etc., but it does not appear that equal consideration and mitigation measures are being applied proportionately.

The DEIS reveals that the project impacts eight (8) Counties, which are Canadian, Grady, Garvin, Stephens, Carter, Johnston, Bryan and Kingfisher. The Counties which bear the greatest

FA2-12 (cont'd) As stated in section 4.5.4 of the EIS, Midship Pipeline has committed to using seed products and mulch materials that are certified weed-free and do not contain state-listed invasive or noxious species. In addition, Midship Pipeline would clean equipment (including construction machinery and vehicles) prior to entering the construction area and before moving onto new sites, and it would document any noxious weed populations observed prior to vegetation clearing and construction. In accordance with section VI.D.5.d of the Procedures, wetland revegetation would be considered successful if invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

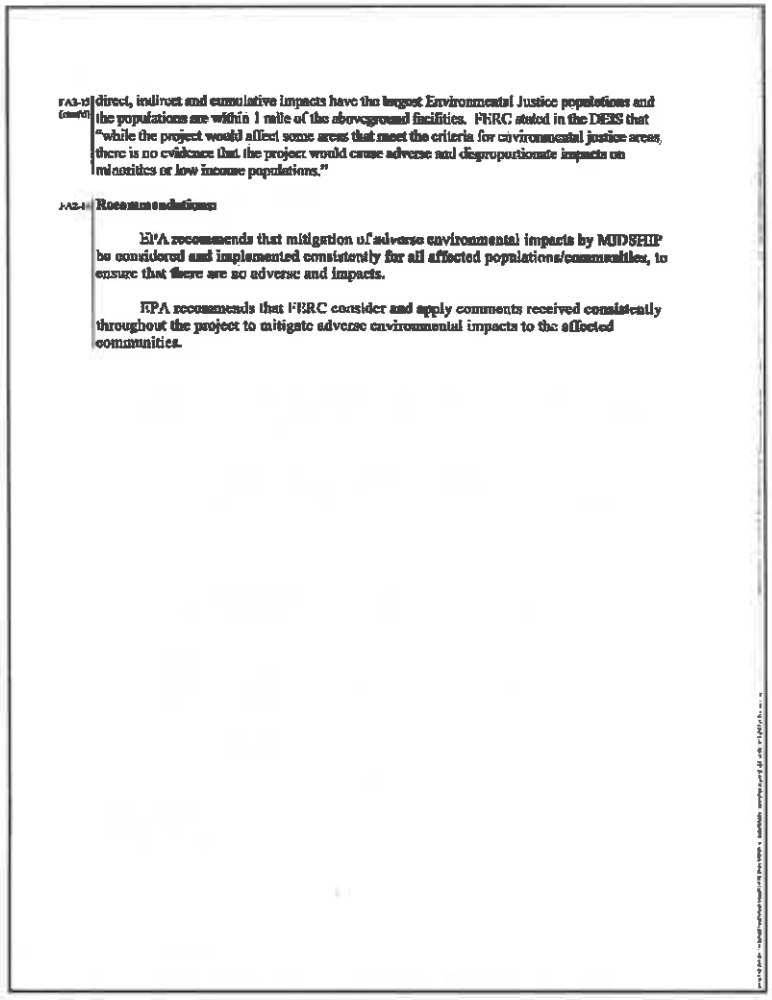
FA2-13 Wetland monitoring would occur for at least 3 years, and would continue until restoration is deemed successful based on the performance measures outlined in section VI.D.5 of the Procedures. FERC would not require additional monitoring after restoration has been documented as successful; however, this could be a condition of other permits obtained by the applicant.

FA2-14 Midship Pipeline has revised its wetland impacts based on reroutes and/or workspace modifications and additional field surveys. The wetland impacts indicated in section 4.4.1 of the EIS have been revised accordingly. As indicated in the EIS, totals may not match the sum of addends due to rounding.

FA2-15 As described in section 3.4 of the EIS, Midship Pipeline's proposed compressor station sites were selected based on optimum horsepower and compressor station location requirements necessary to transport the proposed natural gas volumes; site access and availability; land use; topography; and resources present. As described in sections 4.11.1 and 4.11.2, respectively, emissions from the project's aboveground facilities would meet air quality requirements and comply with required air emissions permits, and the facilities would be designed and constructed to avoid intrusive noise levels at residences, recreational areas, and other special interest areas. As a result, operation of the aboveground facilities would not be expected to have a significant impact on air quality or noise for any population, including environmental justice populations.

As described in section 4.8.8 of the EIS, the existing vegetation present at the Calumet and Tatums Compressor Stations provides sufficient visual screening from nearby residences; therefore, no additional visual screening plans or mitigation were requested of Midship Pipeline. This conclusion is based solely on the existing vegetation or visual screening present at the proposed sites and is not based on the presence of any environmental justice community.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)



FA2-15 (cont'd) direct, indirect and cumulative impacts have the largest Environmental Justice populations and the populations are within 1 mile of the aboveground facilities. FERC stated in the DEIS that "while the project would affect some areas that meet the criteria for environmental justice areas, there is no evidence that the project would cause adverse and disproportionate impacts on minorities or low income populations."

FA2-16 **Recommendations**

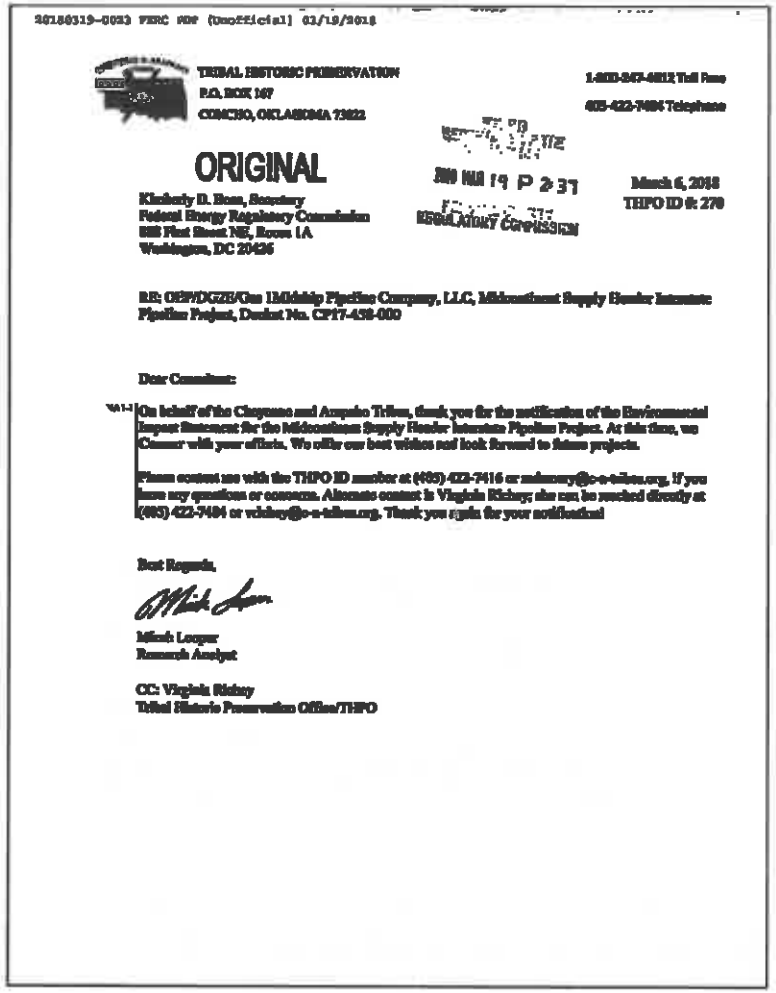
EPA recommends that mitigation of adverse environmental impacts by MIDSHIP be considered and implemented consistently for all affected populations/communities, to ensure that there are no adverse and impacts.

EPA recommends that FERC consider and apply comments received consistently throughout the project to mitigate adverse environmental impacts to the affected communities.

FA2-16 Comments noted.

NATIVE AMERICAN TRIBES (NA)

NA1 – Cheyenne and Arapaho Tribes Tribal Historic Preservation Office



20180319-0033 FERC PDF (Unofficial) 03/19/2018

TRIBAL HISTORIC PRESERVATION
P.O. BOX 167
CONCHO, OKLAHOMA 73022

1-800-247-6612 Toll Free
405-422-7404 Telephone

ORIGINAL

2018 MAR 19 P 2:37

FEDERAL ENERGY REGULATORY COMMISSION

March 6, 2018
THPO ID #: 270

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

RE: OEP/DG2E/Gas 1 Midship Pipeline Company, LLC, Midcontinent Supply Header Interstate Pipeline Project, Docket No. CP17-458-000

Dear Consultant:

NA1-1 On behalf of the Cheyenne and Arapaho Tribes, thank you for the notification of the Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project. At this time, we Concur with your efforts. We offer our best wishes and look forward to future projects.

Please contact me with the THPO ID number at (405) 422-7416 or mdorsey@c-a-tribes.org. If you have any questions or concerns. Alternate contact is Virginia Richey; she can be reached directly at (405) 422-7404 or vrichey@c-a-tribes.org. Thank you again for your notification!

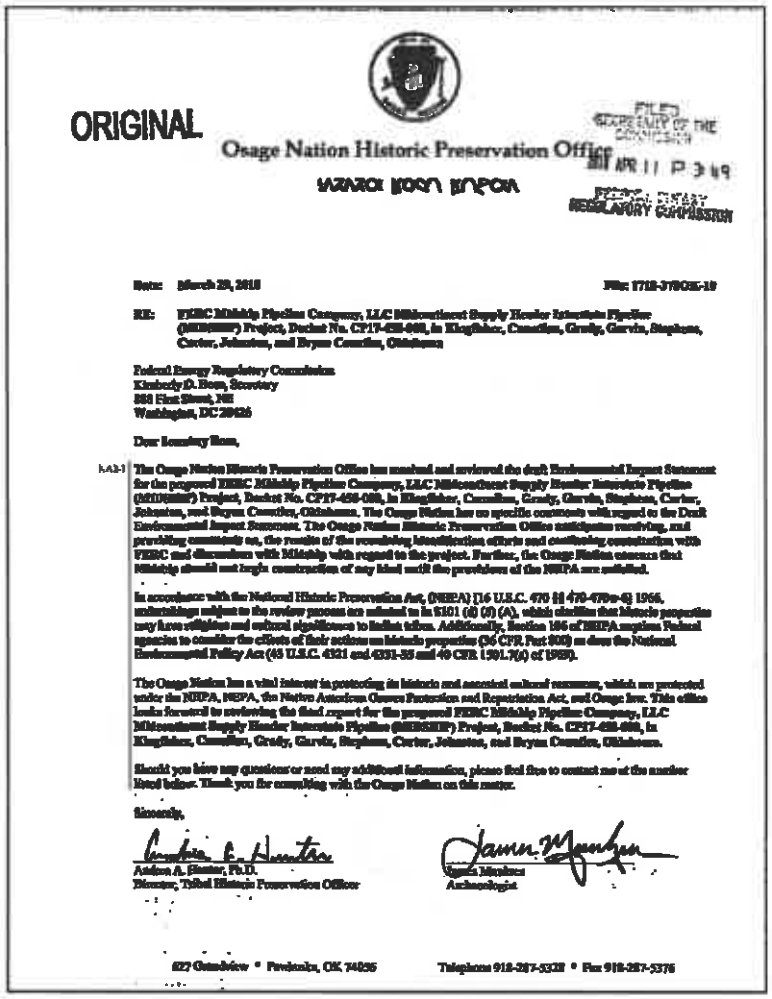
Best Regards,

Mitch Dorsey
Research Analyst

CC: Virginia Richey
Tribal Historic Preservation Office/THPO

NA1-1 Comment noted.

NA2 – Osage National Historic Preservation Office



ORIGINAL

Osage Nation Historic Preservation Office

FILED
SECRETARY OF THE
COMMISSION
APR 11 P 3:49
FEDERAL ENERGY
REGULATORY COMMISSION

Date: March 29, 2018 File: 1718-378OSE-19

RE: FERC Millstip Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-488-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma

Federal Energy Regulatory Commission
Kimberly D. Bose, Secretary
888 First Street, NE
Washington, DC 20426

Dear Secretary Bose,

NA2-1 The Osage Nation Historic Preservation Office has received and reviewed the draft Environmental Impact Statement for the proposed FERC Millstip Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-488-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma. The Osage Nation has no specific comments with regard to the Draft Environmental Impact Statement. The Osage Nation Historic Preservation Office anticipates receiving, and providing comments on, the results of the remaining identification efforts and continuing consultation with FERC and discussions with Millstip with regard to the project. Further, the Osage Nation concurs that Millstip should not begin construction of any kind until the provisions of the NHPA are satisfied.

In accordance with the National Historic Preservation Act, (NHPA) [16 U.S.C. 470 [§ 470-470w-6] 1966, archaeology subject to the review process are referred to in §101 (d) (2) (A), which clarifies that historic properties may have religious and cultural significance to Indian tribes. Additionally, Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties (36 CFR Part 800) as does the National Environmental Policy Act (42 U.S.C. 4321 and 4331-35 and 40 CFR 1501.7(a) of 1969).

The Osage Nation has a vital interest in protecting its historic and ancestral cultural resources, which are protected under the NHPA, NEPA, the Native American Graves Protection and Repatriation Act, and Osage law. This office looks forward to reviewing the final report for the proposed FERC Millstip Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-488-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma.

Should you have any questions or need any additional information, please feel free to contact me at the number listed below. Thank you for consulting with the Osage Nation on this matter.

Sincerely,

Andrea A. Hunter, Ph.D.
Director, Tribal Historic Preservation Officer

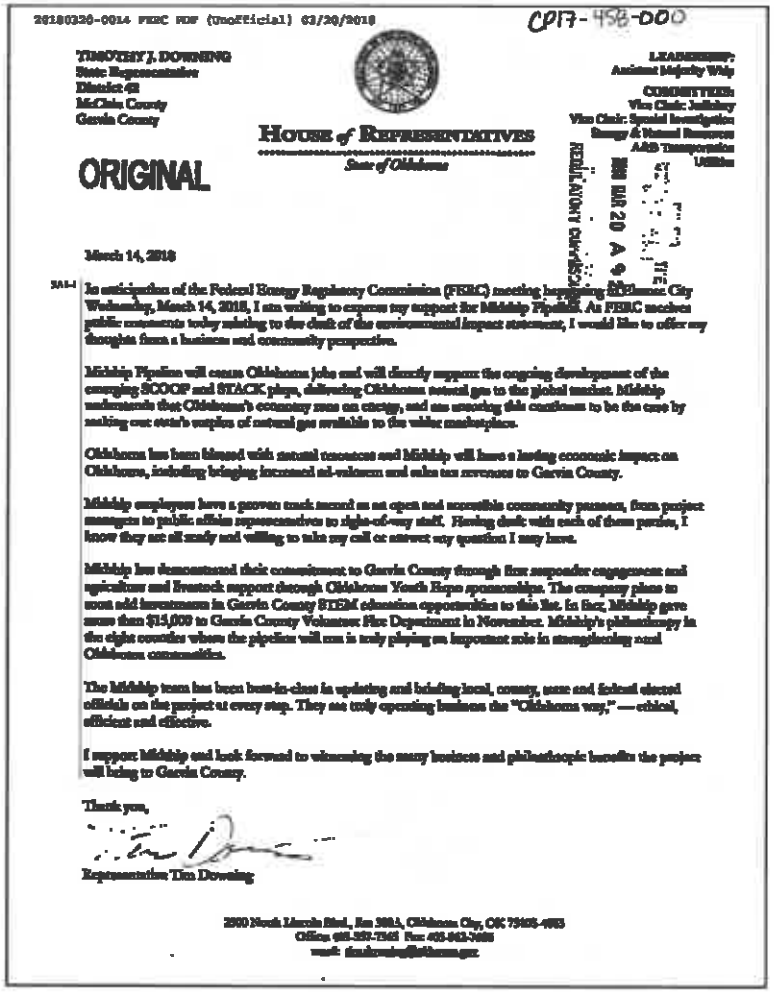
Jason Mayhew
Archaeologist

627 Grandview • Pawhuska, OK 74056 Telephone 918-287-5329 • Fax 918-287-5376

NA2-1 Comments noted.

STATE AGENCIES (SA)

SA1 – Oklahoma House of Representatives, Representative Tim Downing



20180320-0014 FERC PDF (Unofficial) 03/20/2018

CP17-458-000

TIMOTHY J. DOWNING
State Representative
District 48
McClain County
Garvin County

HOUSE of REPRESENTATIVES
State of Oklahoma

LEADERSHIP:
Assistant Majority Whip

COMMITTEES:
Vice Chair: Judiciary
Vice Chair: Special Investigative
Energy & Natural Resources
A&B Transportation
Utilities

ORIGINAL

REGULATORY OFFICE

2018 MAR 20 A 9:

March 14, 2018

SA1-1 In anticipation of the Federal Energy Regulatory Commission (FERC) meeting happening [illegible] City Wednesday, March 14, 2018, I am writing to express my support for Middcip Pipeline. As FERC receives public comments today relating to the draft of the environmental impact statement, I would like to offer my thoughts from a business and community perspective.

Middcip Pipeline will create Oklahoma jobs and will directly support the ongoing development of the emerging SCOOP and STACK plays, delivering Oklahoma natural gas to the global market. Middcip understands that Oklahoma's economy runs on energy, and our growing role continues to be the case by making our state's surplus of natural gas available to the wider marketplace.

Oklahoma has been blessed with natural resources and Middcip will have a lasting economic impact on Oklahoma, including bringing increased ad-valorem and sales tax revenues to Garvin County.

Middcip employees have a proven track record as an open and accessible community partners, from project managers to public affairs representatives to right-of-way staff. Having dealt with each of these parties, I know they are all ready and willing to take my call or answer my question I may have.

Middcip has demonstrated their commitment to Garvin County through first responder engagement and agriculture and livestock support through Oklahoma Youth Expo sponsorships. The company plans to work add investments in Garvin County STEM education opportunities to this list. In fact, Middcip gave more than $15,000 to Garvin County Volunteer Fire Department in November. Middcip's philanthropy in the eight counties where the pipeline will run is truly playing an important role in strengthening rural Oklahoma communities.

The Middcip team has been hands-on-close in updating and briefing local, county, state and federal elected officials on the project at every step. They are truly operating business the "Oklahoma way," — ethical, efficient and effective.

I support Middcip and look forward to witnessing the many business and philanthropic benefits the project will bring to Garvin County.

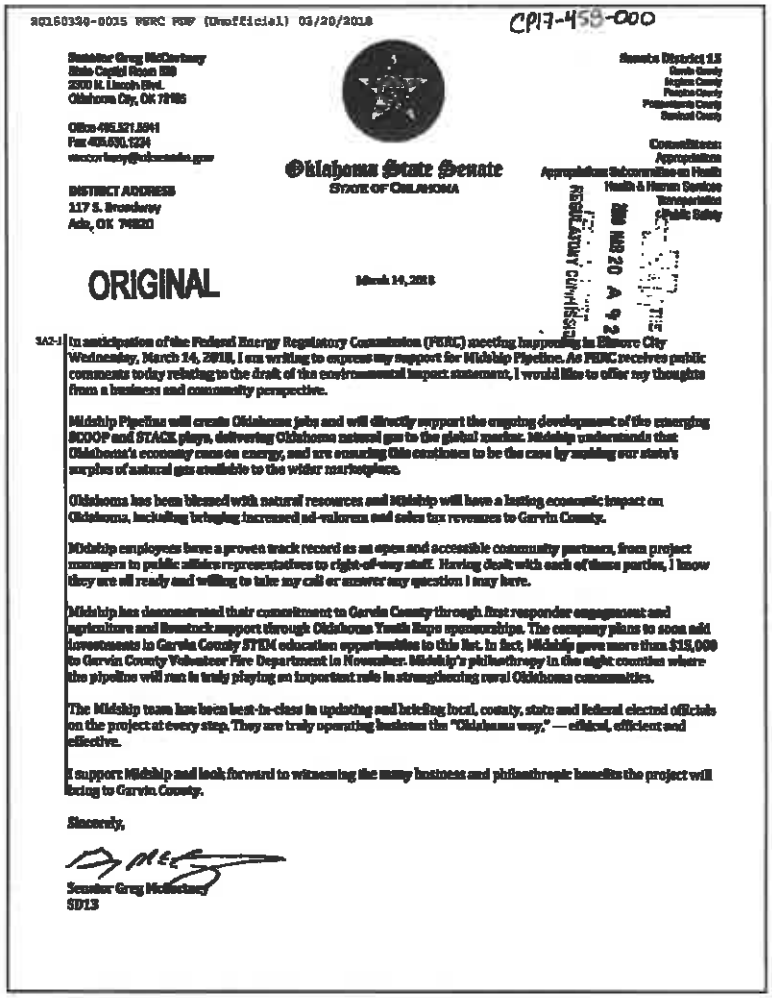
Thank you,

Representative Tim Downing

2300 North Lincoln Blvd., Rm 508A, Oklahoma City, OK 73105-4803
Office: 405-557-7365 Fax: 405-662-7365
email: tim.downing@okhouse.gov

SA1-1 Comments noted.

SA2 – Oklahoma State Senate, Senator Greg McCortney



20180320-0035 FERC PDF (Unofficial) 03/20/2018

CP17-458-000

Senator Greg McCortney
State Capitol Room 418
2300 N. Lincoln Blvd.
Oklahoma City, OK 73105

Office 405.521.5641
Fax 405.521.1234
gregmccortney@oksenate.gov

DISTRICT ADDRESS
117 S. Broadway
Ada, OK 74820

Oklahoma State Senate
STATE OF OKLAHOMA

Senate District 15
Bryan County
Coal County
Pontotoc County
Pottawatomie County
Seminole County

Committees:
Appropriations
Appropriations Subcommittee on Health
Health & Human Services
Transportation
Public Safety

FEDERAL ENERGY REGULATORY COMMISSION
2018 MAR 20 A 9:23
OFFICE OF THE SECRETARY

ORIGINAL

March 14, 2018

SA2-1 In anticipation of the Federal Energy Regulatory Commission (FERC) meeting happening in Elkhorn City Wednesday, March 14, 2018, I am writing to express my support for Midship Pipeline. As FERC receives public comments today relating to the draft of the environmental impact statement, I would like to offer my thoughts from a business and community perspective.

Midship Pipeline will create Oklahoma jobs and will directly support the ongoing development of the emerging SCOOP and STACK plays, delivering Oklahoma natural gas to the global market. Midship understands that Oklahoma's economy runs on energy, and are ensuring this continues to be the case by making our state's surplus of natural gas available to the wider marketplace.

Oklahoma has been blessed with natural resources and Midship will have a lasting economic impact on Oklahoma, including bringing increased ad-valorem and sales tax revenues to Garvin County.

Midship employees have a proven track record as an open and accessible community partners, from project managers to public affairs representatives to right-of-way staff. Having dealt with each of these parties, I know they are all ready and willing to take my call or answer any question I may have.

Midship has demonstrated their commitment to Garvin County through first responder engagement and agriculture and livestock support through Oklahoma Youth Expo sponsorships. The company plans to soon add investments in Garvin County STEM education opportunities to this list. In fact, Midship gave more than $15,000 to Garvin County Volunteer Fire Department in November. Midship's philanthropy in the eight counties where the pipeline will run is truly playing an important role in strengthening rural Oklahoma communities.

The Midship team has been best-in-class in updating and briefing local, county, state and federal elected officials on the project at every step. They are truly operating business the "Oklahoma way," — ethical, efficient and effective.

I support Midship and look forward to witnessing the many business and philanthropic benefits the project will bring to Garvin County.

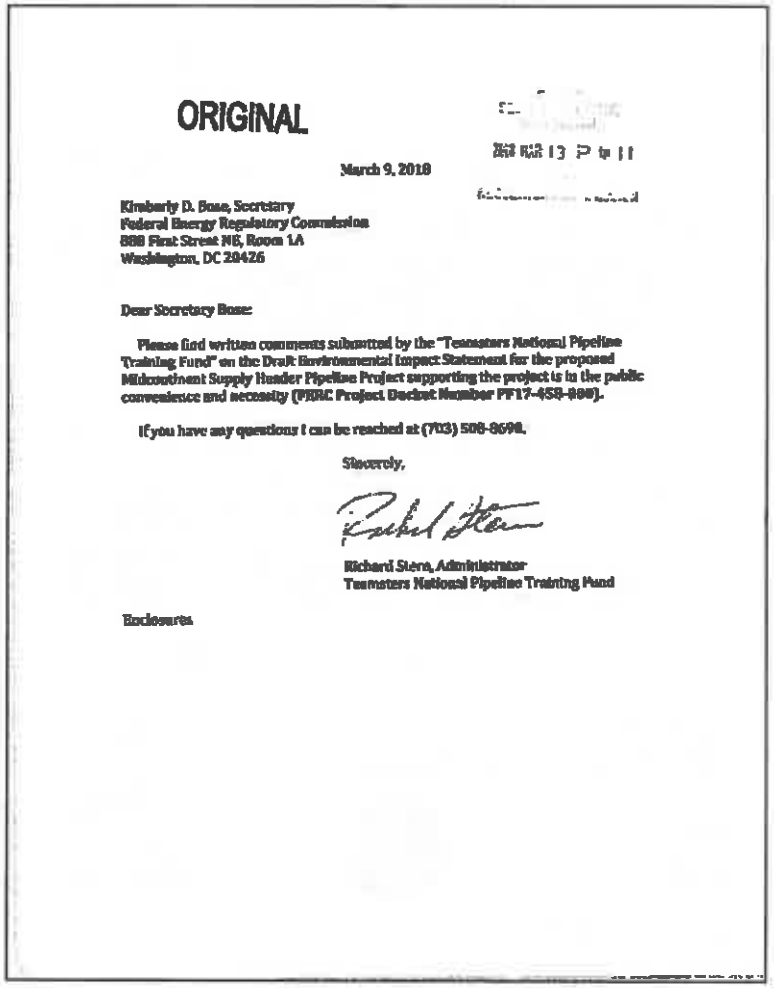
Sincerely,

Senator Greg McCortney
SD13

SA2-1 Comments noted.

COMPANIES AND ORGANIZATIONS (CO)

CO1 –Teamsters National Pipeline Training Fund



ORIGINAL

March 9, 2018

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

Dear Secretary Bose:

Please find written comments submitted by the "Teamsters National Pipeline Training Fund" on the Draft Environmental Impact Statement for the proposed Midcontinent Supply Header Pipeline Project supporting the project is in the public convenience and necessity (FERC Project Docket Number PF17-458-000).

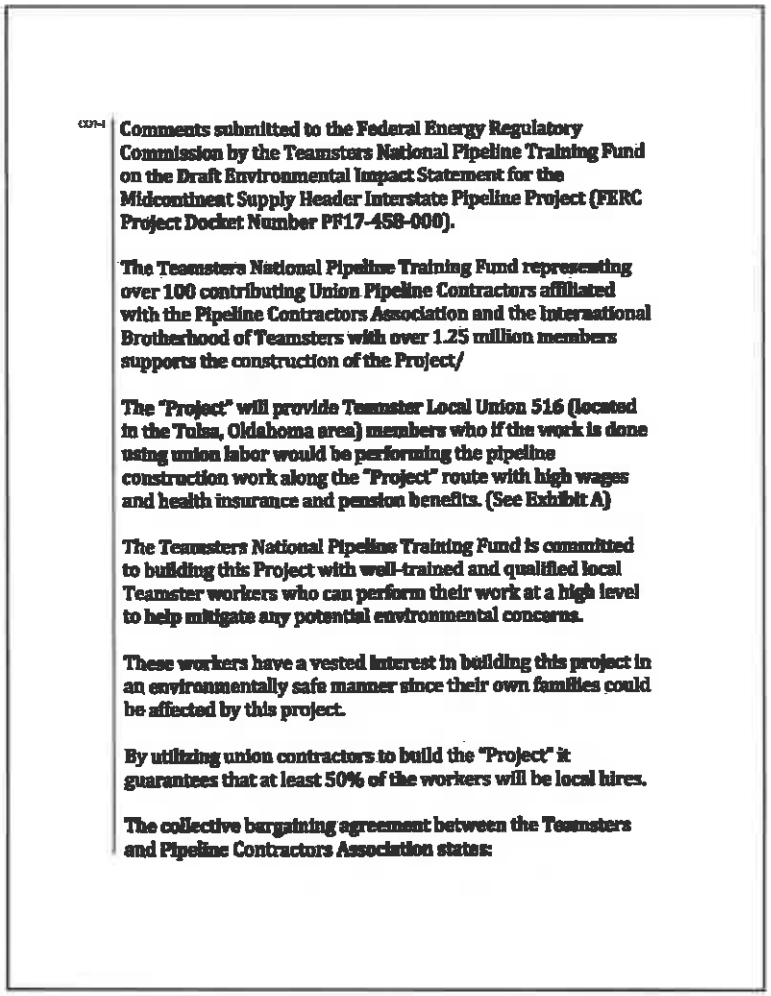
If you have any questions I can be reached at (703) 508-8698.

Sincerely,

Richard Stern, Administrator
Teamsters National Pipeline Training Fund

Enclosures

CO1 –Teamsters National Pipeline Training Fund (cont'd)



CO1-1

Comments submitted to the Federal Energy Regulatory Commission by the Teamsters National Pipeline Training Fund on the Draft Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project (FERC Project Docket Number PF17-458-000).

The Teamsters National Pipeline Training Fund representing over 100 contributing Union Pipeline Contractors affiliated with the Pipeline Contractors Association and the International Brotherhood of Teamsters with over 1.25 million members supports the construction of the Project/

The "Project" will provide Teamster Local Union 516 (located in the Tulsa, Oklahoma area) members who if the work is done using union labor would be performing the pipeline construction work along the "Project" route with high wages and health insurance and pension benefits. (See Exhibit A)

The Teamsters National Pipeline Training Fund is committed to building this Project with well-trained and qualified local Teamster workers who can perform their work at a high level to help mitigate any potential environmental concerns.

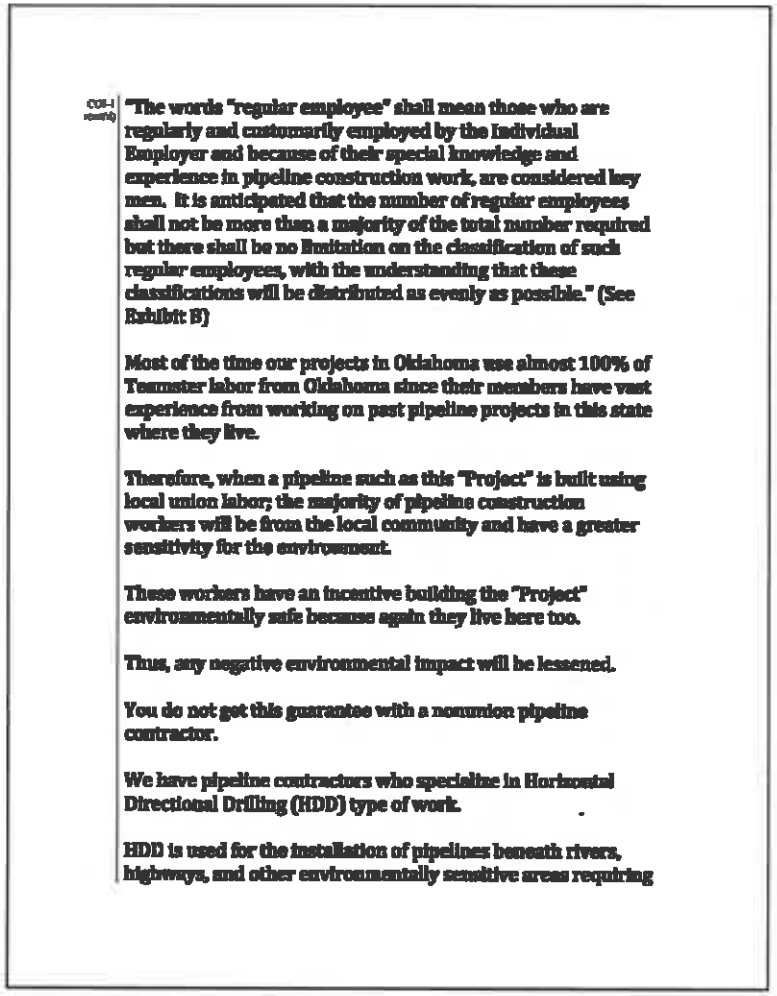
These workers have a vested interest in building this project in an environmentally safe manner since their own families could be affected by this project.

By utilizing union contractors to build the "Project" it guarantees that at least 50% of the workers will be local hires.

The collective bargaining agreement between the Teamsters and Pipeline Contractors Association states:

CO1-1 Comments noted.

CO1 –Teamsters National Pipeline Training Fund (cont'd)



CO1-I cont'd

"The words "regular employee" shall mean those who are regularly and customarily employed by the Individual Employer and because of their special knowledge and experience in pipeline construction work, are considered key men. It is anticipated that the number of regular employees shall not be more than a majority of the total number required but there shall be no limitation on the classification of such regular employees, with the understanding that these classifications will be distributed as evenly as possible." (See Exhibit B)

Most of the time our projects in Oklahoma use almost 100% of Teamster labor from Oklahoma since their members have vast experience from working on past pipeline projects in this state where they live.

Therefore, when a pipeline such as this "Project" is built using local union labor; the majority of pipeline construction workers will be from the local community and have a greater sensitivity for the environment.

These workers have an incentive building the "Project" environmentally safe because again they live here too.

Thus, any negative environmental impact will be lessened.

You do not get this guarantee with a nonunion pipeline contractor.

We have pipeline contractors who specialize in Horizontal Directional Drilling (HDD) type of work.

HDD is used for the installation of pipelines beneath rivers, highways, and other environmentally sensitive areas requiring

CO1 –Teamsters National Pipeline Training Fund (cont'd)

CO1-1 (cont'd)

technology and equipment that can install pipelines without any disturbance to natural habitats.

Some of our specialized signatory contractors and a more detailed explanation of the work they perform in areas of great environmental concern are included in this submission. (See Exhibit C)

Prior to the construction of this "Project" we will provide Classroom training programs based on the U.S. Department Transportation's Regulations on "Compliance, Safety and Accountability" (CSA) and also Defensive Driving.

The Teamsters CSA/Defensive Driving Instructor has been cited as a Trend Setter by the "National Safety Council" an Award he has received from them in the past. (See Exhibit D)

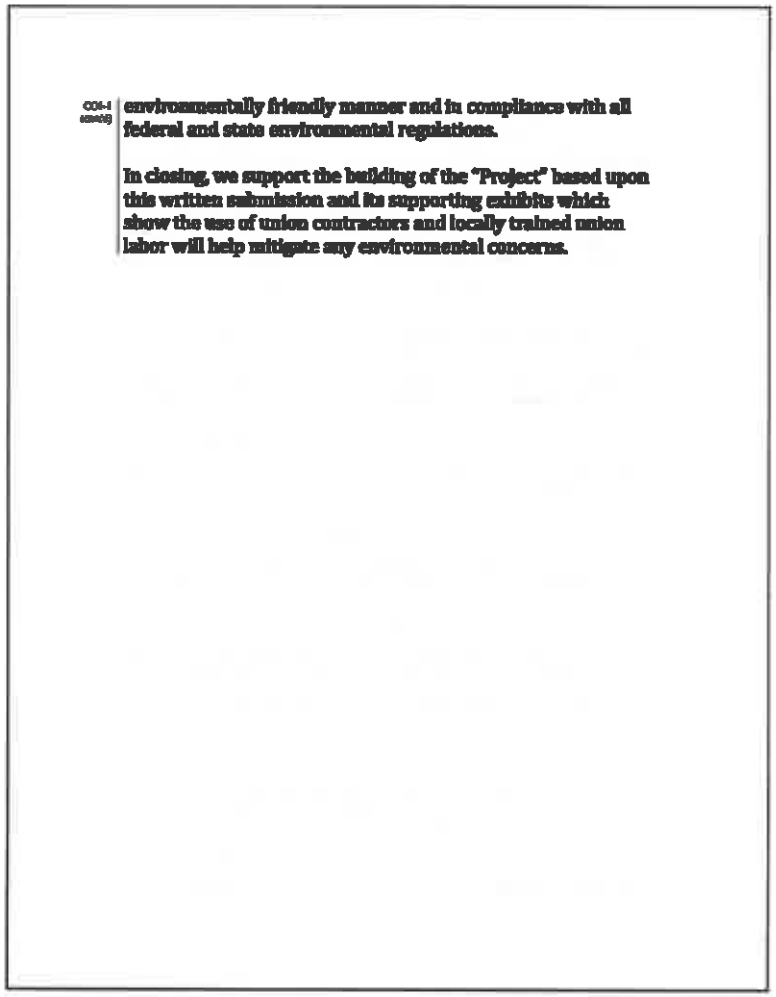
Under pages 6 and 7 in the collective bargaining agreement workers must have certain qualifications prior to working on this project. (See Exhibit E)

Under pages 17 and 18 of the Pipeline Agreement is the language on "Drug and Alcohol Testing" to ensure a drug free work environment and "Training/DOT Rules" to maintain high quality work standards and qualifications. (See Exhibit F)

For your ready-reference we have provided brochures detailing information about our Training Program and us and our support for our Oklahoma Veterans who will be working on the "Project". (See Exhibit G)

We believe that if this "Project" is constructed with our trained and highly skilled local union workers and specialized union contractors the "Project" will be built in a safe and

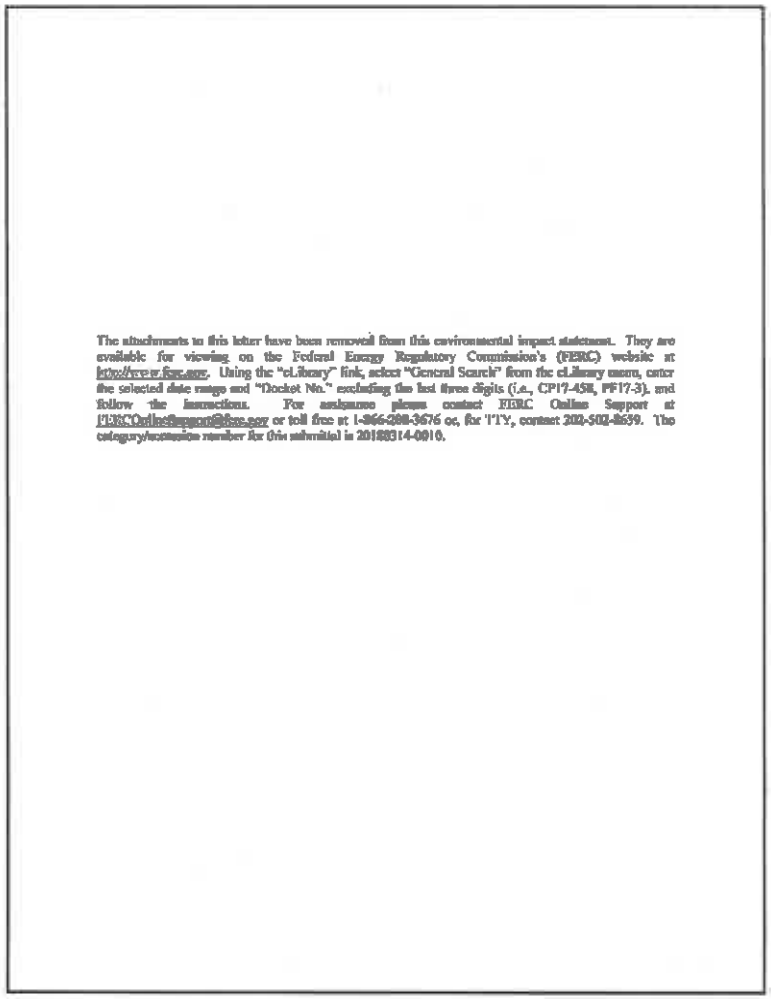
CO1 –Teamsters National Pipeline Training Fund (cont'd)



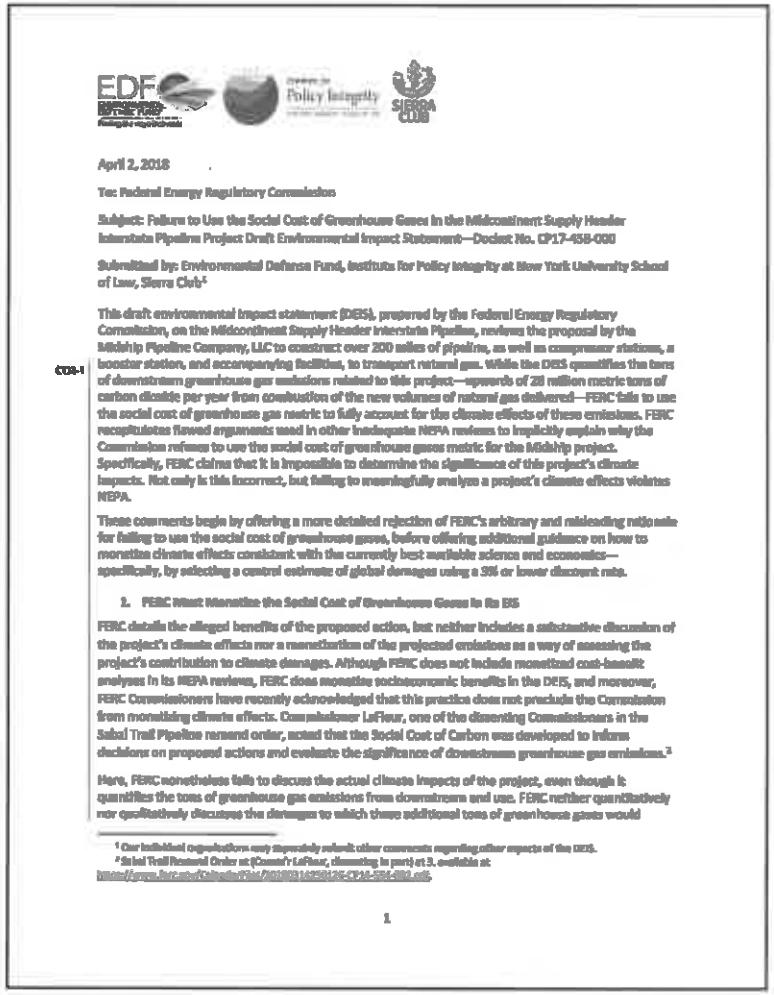
CO1-I (cont'd) environmentally friendly manner and in compliance with all federal and state environmental regulations.

In closing, we support the building of the "Project" based upon this written submission and its supporting exhibits which show the use of union contractors and locally trained union labor will help mitigate any environmental concerns.

CO1 –Teamsters National Pipeline Training Fund (cont'd)


The attachments to this letter have been removed from this environmental impact statement. They are available for viewing on the Federal Energy Regulatory Commission's (FERC) website at http://www.ferc.gov. Using the "eLibrary" link, select "General Search" from the eLibrary menu, enter the selected date range and "Docket No." excluding the last three digits (i.e., CP17-458, PF17-3), and follow the instructions. For assistance please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676 or, for TTY, contact 202-502-8659. The category/accession number for this submittal is 20180314-0010.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club



April 2, 2018

To: Federal Energy Regulatory Commission

Subject: Failure to Use the Social Cost of Greenhouse Gases in the Midcontinent Supply Header Interstate Pipeline Project Draft Environmental Impact Statement—Docket No. CP17-458-000

Submitted by: Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club[1]

CO2-1

This draft environmental impact statement (DEIS), prepared by the Federal Energy Regulatory Commission, on the Midcontinent Supply Header Interstate Pipeline, reviews the proposal by the Midship Pipeline Company, LLC to construct over 200 miles of pipeline, as well as compressor stations, a booster station, and accompanying facilities, to transport natural gas. While the DEIS quantifies the tons of downstream greenhouse gas emissions related to this project—upwards of 28 million metric tons of carbon dioxide per year from combustion of the new volumes of natural gas delivered—FERC fails to use the social cost of greenhouse gas metric to fully account for the climate effects of these emissions. FERC recapitulates flawed arguments used in other inadequate NEPA reviews to implicitly explain why the Commission refuses to use the social cost of greenhouse gases metric for the Midship project. Specifically, FERC claims that it is impossible to determine the significance of this project's climate impacts. Not only is this incorrect, but failing to meaningfully analyze a project's climate effects violates NEPA.

These comments begin by offering a more detailed rejection of FERC's arbitrary and misleading rationale for failing to use the social cost of greenhouse gases, before offering additional guidance on how to monetize climate effects consistent with the currently best available science and economics—specifically, by selecting a central estimate of global damages using a 3% or lower discount rate.

1. FERC Must Monetize the Social Cost of Greenhouse Gases in Its EIS

FERC details the alleged benefits of the proposed action, but neither includes a substantive discussion of the project's climate effects nor a monetization of the projected emissions as a way of assessing the project's contribution to climate damages. Although FERC does not include monetized cost-benefit analyses in its NEPA reviews, FERC does monetize socioeconomic benefits in the DEIS, and moreover, FERC Commissioners have recently acknowledged that this practice does not preclude the Commission from monetizing climate effects. Commissioner LaFleur, one of the dissenting Commissioners in the Sabal Trail Pipeline remand order, noted that the Social Cost of Carbon was developed to inform decisions on proposed actions and evaluate the significance of downstream greenhouse gas emissions.[2]

Here, FERC nonetheless fails to discuss the actual climate impacts of the project, even though it quantifies the tons of greenhouse gas emissions from downstream end use. FERC neither quantitatively nor qualitatively discusses the damages to which these additional tons of greenhouse gases would

[1] Our individual organizations may separately submit other comments regarding other aspects of the DEIS.

[2] Sabal Trail Remand Order at (Comm'r LaFleur, dissenting in part) at 3, available at https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14250126-CP15-554-000.pdf.

1

CO2-1 The general nature of the comments is that greenhouse gas (GHG) emissions should be monetized because other socioeconomic costs and benefits are monetized in the EIS; quantifying the social cost of carbon (SCC) would give context to the climate damages associated with project GHG emissions; SCC is appropriate for analyzing project-level emissions of the magnitude of the MIDSHIP Project; FERC must use the SCC tools that reflect currently available data and methodologies, and; FERC must quantify global damages associated with project GHG emissions.

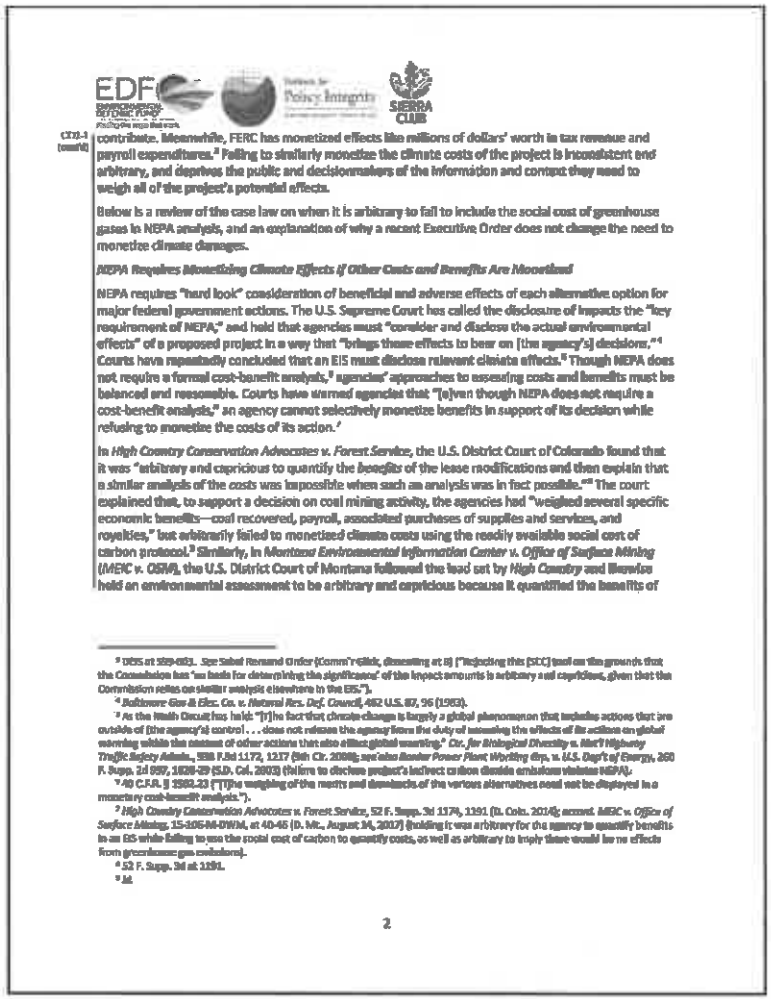
The SCC tool, as well as the Social Cost of Methane and Nitrous Oxide tools, estimates the monetized climate change damage associated with an incremental increase in carbon dioxide (CO_2) emissions in the given year. It estimates the cost today of future climate change damage, represented by a series of annual costs per metric ton of emissions discounted to present-day value.

We recognize the availability of the SCC tool, but conclude that it is not appropriate for use in project analyses for the following reasons:

(1) The SCC is not meaningful in our National Environmental Policy Act (NEPA) analysis for project decisions under the Natural Gas Act (NGA). We believe that the SCC tool is more appropriately used in NEPA analyses by regulators whose responsibilities are tied more directly to fossil fuel production or consumption. The Commission's authority under section 7 of the NGA has no direct connection to the production or end use of natural gas. The Commission does not control the production or consumption of natural gas. Producers, consumers, and their intermediaries respond freely to market signals about location-specific supply and location-specific demand. The Commission oversees proposals to transport natural gas between those locations. Our NEPA analysis considers all construction emissions and annual operational GHG emissions that are causally related to the proposed action that is before the Commission.

[Note: This response is continued on the next page.]

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd) contribute. Meanwhile, FERC has monetized effects like millions of dollars' worth in tax revenue and payroll expenditures.[2] Failing to similarly monetize the climate costs of the project is inconsistent and arbitrary, and deprives the public and decisionmakers of the information and context they need to weigh all of the project's potential effects.

Below is a review of the case law on when it is arbitrary to fail to include the social cost of greenhouse gases in NEPA analysis, and an explanation of why a recent Executive Order does not change the need to monetize climate damages.

NEPA Requires Monetizing Climate Effects if Other Costs and Benefits Are Monetized

NEPA requires "hard look" consideration of beneficial and adverse effects of each alternative option for major federal government actions. The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the actual environmental effects" of a proposed project in a way that "brings those effects to bear on [the agency's] decisions."[4] Courts have repeatedly concluded that an EIS must disclose relevant climate effects.[5] Though NEPA does not require a formal cost-benefit analysis,[6] agencies' approaches to assessing costs and benefits must be balanced and reasonable. Courts have warned agencies that "[e]ven though NEPA does not require a cost-benefit analysis," an agency cannot selectively monetize benefits in support of its decision while refusing to monetize the costs of its action.[7]

In *High Country Conservation Advocates v. Forest Service*, the U.S. District Court of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible."[8] The court explained that, to support a decision on coal mining activity, the agencies had "weighed several specific economic benefits—coal recovered, payroll, associated purchases of supplies and services, and royalties," but arbitrarily failed to monetized climate costs using the readily available social cost of carbon protocol.[9] Similarly, in *Montana Environmental Information Center v. Office of Surface Mining (MEIC v. OSM)*, the U.S. District Court of Montana followed the lead set by *High Country* and likewise held an environmental assessment to be arbitrary and capricious because it quantified the benefits of

[2] DEIS at 3-69-483. *See* Sabal Remand Order (Comm'r Glick, dissenting at 8) ("Rejecting this [SCC] tool on the grounds that the Commission has 'no basis for determining the significance' of the impact amounts is arbitrary and capricious, given that the Commission relies on similar analysis elsewhere in the EIS.").

[4] *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 96 (1983).

[5] As the Ninth Circuit has held: "[t]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming." *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (failure to disclose project's indirect carbon dioxide emissions violates NEPA).

[7] 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis.").

[8] *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014); accord. *MEIC v. Office of Surface Mining*, 15-105-M-DWM, at 40-45 (D. Mt., August 14, 2017) (holding it was arbitrary for the agency to quantify benefits in an EIS while failing to use the social cost of carbon to quantify costs, as well as arbitrary to imply there would be no effects from greenhouse gas emissions).

[9] 52 F. Supp. 3d at 1191.

[6] *Id.*

2

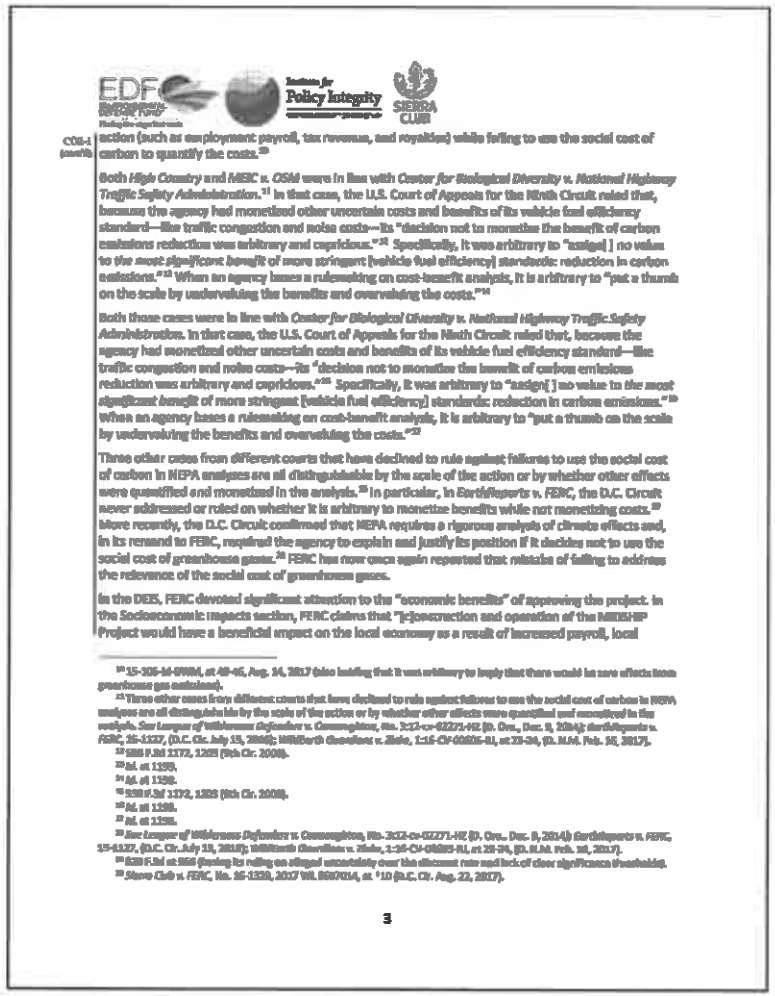
CO2-1 (cont'd) (2) FERC staff does not use monetized cost-benefit analyses as part of the NEPA review. Siting infrastructure involves making qualitative judgments between different resources as to which there is no agreed-upon quantitative value. As such, we do not conduct a monetary cost-benefit analysis in our NEPA review. The draft EIS did quantify some of the MIDSHIP Project's direct socioeconomic benefits (e.g., employment and tax payments) because those benefits occur in units of dollars and are directly comprehensible in units of dollars. However, because Commission staff lack quantified information about all of the costs and benefits of the project, the final EIS does not use the limited available quantified benefits in a cost-benefit analysis to inform Commission staff's comparison of alternatives, choices of mitigation measures, or determination about the significance of the MIDSHIP Project's environmental impacts.

FERC staff notes that the MIDSHIP Project draft EIS used various tools and measurements to disclose and quantify potential impacts associated with the project. FERC staff chose quantification tools appropriate to each individual resource. For example, the EIS used acres of wetland disturbance, number of existing residences within 50 feet of the proposed construction right-of-way, decibels of noise associated with operation of aboveground facilities, and, as presented in section 4.9.7 of the draft EIS, dollar amounts were estimated to present potential economic effects of the project. For GHG emissions, FERC staff used tons of GHG emissions to quantify and disclose the potential impacts of GHG emissions associated with the project. We believe that providing estimated tons of GHG emissions was an appropriate tool to use to quantify the potential GHG impacts associated with the project.

(3) The SCC tool has technical limitations that limit its usefulness in NEPA analyses for Commission certificate proceedings. FERC staff acknowledges that the SCC methodology does constitute a tool that can be used to estimate incremental physical climate change impacts. The integrated assessment models underlying the SCC tool were developed to estimate certain global and regional physical climate change impacts due to incremental GHG emissions under specific socioeconomic scenarios. However, the EPA states that "no consensus exists on the appropriate [discount] rate to use for analyses spanning multiple generations" and consequently, significant variation in output can result.

[Note: This response is continued on the next page.]

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

action (such as employment payroll, tax revenue, and royalties) while failing to use the social cost of carbon to quantify the costs.[20]

Both *High Country* and *MEIC v. OSM* were in line with *Center for Biological Diversity v. National Highway Traffic Safety Administration*.[21] In that case, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[22] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[23] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[24]

Both *High Country* and *MEIC v. OSM* were in line with *Center for Biological Diversity v. National Highway Traffic Safety Administration*. In that case, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[22] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[23] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[24]

Three other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis.[25] In particular, in *EarthReports v. FERC*, the D.C. Circuit never addressed or ruled on whether it is arbitrary to monetize benefits while not monetizing costs.[26] More recently, the D.C. Circuit confirmed that NEPA requires a rigorous analysis of climate effects and, in its remand to FERC, required the agency to explain and justify its position if it decides not to use the social cost of greenhouse gases.[27] FERC has now once again repeated that mistake of failing to address the relevance of the social cost of greenhouse gases.

In the DEIS, FERC devoted significant attention to the "economic benefits" of approving the project. In the Socioeconomic Impacts section, FERC claims that "[c]onstruction and operation of the MIDSHIP Project would have a beneficial impact on the local economy as a result of increased payroll, local

[20] 15-305-M-SWM, at 48-45, Aug. 14, 2017 (also holding that it was arbitrary to imply that there would be zero effects from greenhouse gas emissions).

[21] Three other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis. *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 8, 2014); *EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00805-RJ, at 33-34, (D. N.M. Feb. 16, 2017).

[22] 538 F.3d 1172, 1203 (9th Cir. 2008).

[23] *Id.* at 1199.

[24] *Id.* at 1198.

[25] 538 F.3d 1172, 1203 (9th Cir. 2008).

[26] *Id.* at 1198.

[27] *Id.* at 1199.

[28] *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 8, 2014); *EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00805-RJ, at 33-34, (D. N.M. Feb. 16, 2017).

[29] 838 F.3d at 868 (noting its ruling on alleged uncertainty over the discount rate and lack of clear significance threshold).

[30] *Sierra Club v. FERC*, No. 16-1329, 2017 WL 8097014, at *10 (D.C. Cir. Aug. 22, 2017).

3

CO2-1 (cont'd) Additionally, there are no established criteria identifying the monetized values that are to be considered significant for NEPA reviews. Therefore, although the integrated assessment models could be run through a first phase to estimate global and regional physical climate change impacts from MIDSHIP Project-related GHG emissions, we would still have to arbitrarily determine what potential increase in atmospheric GHG concentration, rise in sea level, rise in sea water temperatures, and other calculated physical impacts would be significant for a particular pipeline project. Because we have no basis to designate a particular dollar figure calculated from the SCC tool as "significant," such action would be arbitrary and would meaningfully inform neither the NEPA conclusions nor the public.

For these reasons, FERC staff chose not to use the SCC tool in the MIDSHIP Project NEPA analysis.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

materials and services purchased, and utilization of local vendors."[21] FERC monetizes economic benefits, including tax revenue ($26.4 million in sales tax during construction), incomes generated by the new operations positions ($1.6 million for 12 to 14 new positions), the purchasing of goods and services locally ($70,000), and ad valorem tax revenue (ranging from $2.7 to $19.3 million). FERC specifically refers to these effects as the project's "long-term cumulative benefits."[22]

Because FERC has monetized the economic benefits of the project, it must treat the climate costs with proportional analytical rigor and apply the social cost of greenhouse gas metrics. Moreover, in obligating agencies to take "hard look" at projects' climate impacts, NEPA requires more than simply disclosing the volume of anticipated emissions.[23] As discussed further below, under NEPA, agencies must provide details on discrete effects of a project's impacts within the relevant context. The social cost of greenhouse gases provides this critical information.

The importance of this "hard look" consideration is not lost on all members of the Commission. FERC Commissioner Glick, in his dissenting opinion to the Sabal Trail Pipeline remand order, strongly condemns the Commission's wholly inadequate treatment of that pipeline's climate effects: "Willful ignorance of readily available analytical tools to support an enhanced qualitative assessment for the single largest environmental threat in our lifetime will undermine informed public comments and informed decisionmaking."[24]

The Social Cost of Greenhouse Gases Metrics Give Necessary Context to Climate Damages

FERC appears to assert that by explaining that the downstream emissions from this project would constitute "no more than . . . a 0.5 percent increase in national emissions," it has satisfied its NEPA obligations to provide the public and decisionmakers with a meaningful discussion of the project's climate impacts. It has not.

Monetizing climate damages provides the informational context required by NEPA, while a purely quantitative estimate of tons or a qualitative description of discrete climate effects like sea-level rise provide little context. Courts review NEPA documents "under an arbitrary and capricious standard," which requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences," to "foster both informed decisionmaking and informed public participation."[25] In particular, "the impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impact analysis that NEPA requires," and it is arbitrary to fail to "provide the necessary contextual information about the cumulative and incremental environmental impacts."[26]

To "provide the necessary contextual information," economic theory shows that one useful tool is monetization of environmental impacts. As Professor Cass Sunstein has explained, drawing from the work of recent Nobel laureate economist Richard Thaler, a well-documented mental heuristic called "probability neglect" causes people to irrationally reduce small probability risks entirely down to zero.[27]

[21] DEIS at 4-119

[22] DEIS at ES-13 ("Some long-term cumulative benefits would be realized through new jobs and wages, purchases of goods and materials, and tax revenues.").

[23] *Supra* notes 4-5.

[24] Glick opinion at 8.

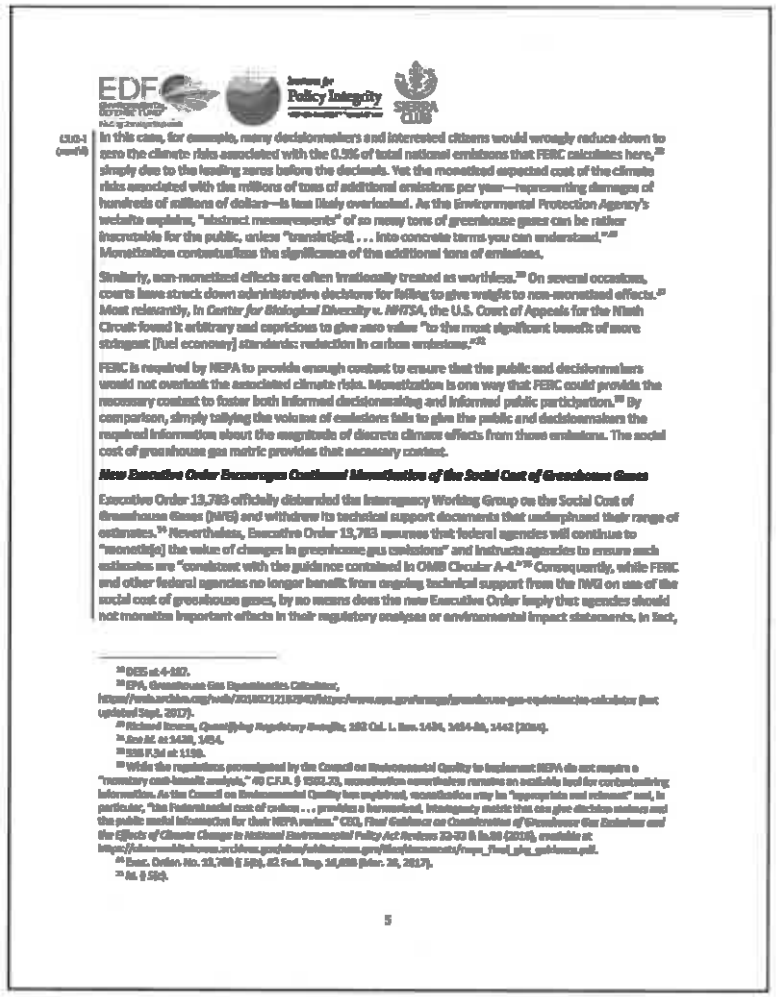
[25] *Ctr. for Biological Diversity*, 538 F.3d at 1194 (citations omitted). *See also Montana Envtl. Info. Ctr. v. Office of Surface Mining*, cv 15-106-M-DWM, at 12-13 (D.Mt., Aug. 24, 2017).

[26] *Ctr. for Biological Diversity*, 538 F.3d at 1217; *see also Montana Envtl. Info. Ctr.*, cv 15-106-M-DWM at 45.

[27] Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 Yale L. J. 61, 63, 72 (2002).

4

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CL01-1 (cont'd)

In this case, for example, many decisionmakers and interested citizens would wrongly reduce down to zero the climate risks associated with the 0.3% of total national emissions that FERC calculates here,[20] simply due to the leading zeros before the decimals. Yet the monetized expected cost of the climate risks associated with the millions of tons of additional emissions per year—representing damages of hundreds of millions of dollars—is less likely overlooked. As the Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand."[21] Monetization contextualizes the significance of the additional tons of emissions.

Similarly, non-monetized effects are often irrationally treated as worthless.[22] On several occasions, courts have struck down administrative decisions for failing to give weight to non-monetized effects.[23] Most relevantly, in *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit found it arbitrary and capricious to give zero value "to the most significant benefit of more stringent [fuel economy] standards: reduction in carbon emissions."[24]

FERC is required by NEPA to provide enough context to ensure that the public and decisionmakers would not overlook the associated climate risks. Monetization is one way that FERC could provide the necessary context to foster both informed decisionmaking and informed public participation.[25] By comparison, simply tallying the volume of emissions fails to give the public and decisionmakers the required information about the magnitude of discrete climate effects from those emissions. The social cost of greenhouse gas metric provides that necessary context.

New Executive Order Encourages Continued Monetization of the Social Cost of Greenhouse Gases

Executive Order 13,783 officially disbanded the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) and withdrew its technical support documents that underpinned their range of estimates.[26] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[27] Consequently, while FERC and other federal agencies no longer benefit from ongoing technical support from the IWG on one of the social cost of greenhouse gases, by no means does the new Executive Order imply that agencies should not monetize important effects in their regulatory analyses or environmental impact statements. In fact,

[20] DEIS at 4-187.

[21] EPA, Greenhouse Gas Equivalencies Calculator, https://web.archive.org/web/20180221183940/https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017).

[22] Richard Revesz, *Quantifying Regulatory Benefits*, 102 Cal. L. Rev. 1423, 1434-36, 1442 (2014).

[23] *See id.* at 1428, 1454.

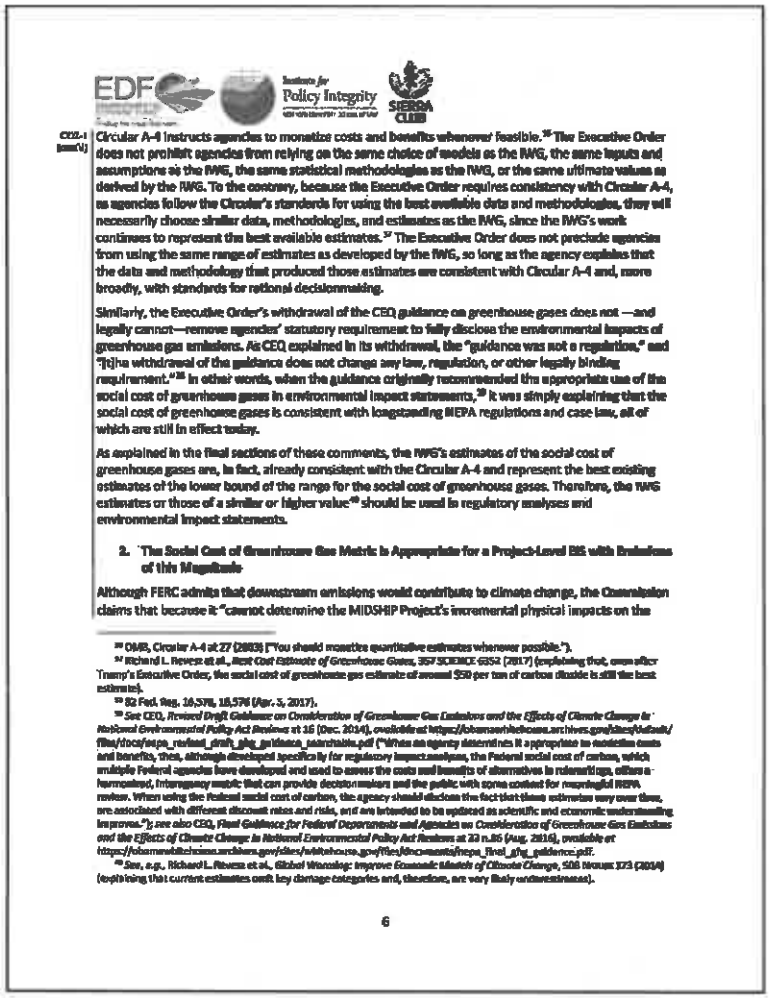
[24] 538 F.3d at 1198.

[25] While the regulations promulgated by the Council on Environmental Quality to implement NEPA do not require a "monetary cost-benefit analysis," 40 C.F.R. § 1502.23, monetization nevertheless remains an available tool for contextualizing information. As the Council on Environmental Quality has explained, monetization may be "appropriate and relevant" and, in particular, "the Federal social cost of carbon . . . provides a harmonized, interagency metric that can give decision makers and the public useful information for their NEPA review." CEQ, *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* 29-33 & fn.80 (2016), available at https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

[26] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017).

[27] *Id.* § 5(c).

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

Circular A-4 instructs agencies to monetize costs and benefits whenever feasible.[36] The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG, or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the best available estimates.[37] The Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decisionmaking.

Similarly, the Executive Order's withdrawal of the CEQ guidance on greenhouse gases does not —and legally cannot—remove agencies' statutory requirement to fully disclose the environmental impacts of greenhouse gas emissions. As CEQ explained in its withdrawal, the "guidance was not a regulation," and "[t]he withdrawal of the guidance does not change any law, regulation, or other legally binding requirement."[38] In other words, when the guidance originally recommended the appropriate use of the social cost of greenhouse gases in environmental impact statements,[39] it was simply explaining that the social cost of greenhouse gases is consistent with longstanding NEPA regulations and case law, all of which are still in effect today.

As explained in the final sections of these comments, the IWG's estimates of the social cost of greenhouse gases are, in fact, already consistent with the Circular A-4 and represent the best existing estimates of the lower bound of the range for the social cost of greenhouse gases. Therefore, the IWG estimates or those of a similar or higher value[40] should be used in regulatory analyses and environmental impact statements.

2. The Social Cost of Greenhouse Gas Metric Is Appropriate for a Project-Level EIS with Evaluations of this Magnitude

Although FERC admits that downstream emissions would contribute to climate change, the Commission claims that because it "cannot determine the MIDSHIP Project's incremental physical impacts on the

[36] OMB, Circular A-4 at 27 (2003) ("You should monetize quantitative estimates whenever possible.").

[37] Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 6352 (2017) (explaining that, even after Trump's Executive Order, the social cost of greenhouse gas estimate of around $50 per ton of carbon dioxide is still the best estimate).

[38] 82 Fed. Reg. 16,576, 16,576 (Apr. 5, 2017).

[39] *See* CEQ, *Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 16 (Dec. 2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_publication.pdf ("When an agency determines it appropriate to monetize costs and benefits, then, although developed specifically for regulatory impact analyses, the Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review. When using the Federal social cost of carbon, the agency should disclose the fact that these estimates vary over time, are associated with different discount rates and risk, and are intended to be updated as scientific and economic understanding improves."); *see also* CEQ, *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 33 n.86 (Aug. 2016), *available at* https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

[40] *See, e.g.*, Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates).

6

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

environment caused by climate change, it cannot determine whether the project's contribution to cumulative impacts on climate change would be significant."[42] This same spurious argument was made in the Sabal Trail remand order. One dissenting opinion to that order, from Commissioner LaFleur,[43] rejects the Commission's claims that it is unable to determine the significance of greenhouse gas emissions.

Despite FERC's claims in the Sabal Trail remand order that the social cost of greenhouse gases only apply to rulemakings,[44] the social cost of greenhouse gas methodology is well suited to measure the marginal climate damages of individual projects. These protocols were developed to assess the cost of actions with "marginal" impacts on cumulative global emissions, and the metrics estimate the dollar figure of damages for one extra unit of greenhouse gas emissions. This marginal cost is calculated using integrated assessment models. These models translate emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature, and changes in temperature into economic damages. A range of plausible socio-economic and emissions trajectories are used to account for the scope of potential scenarios and circumstances that may actually result in the coming years and decades. The marginal cost is attained by first running the models using a baseline emissions trajectory, and then running the same models again with one additional unit of emissions. The difference in damages between the two runs is the marginal cost of one additional unit. The approach assumes that the marginal damages from increased emissions will remain constant for small emissions increases relative to gross global emissions. In other words, the monetization tools are in fact perfectly suited to measuring the marginal effects of individual projects or other discrete agency actions.

The Tons of Greenhouse Gas Emissions at Stake Here Are Clearly Significant

FERC quantifies that downstream emissions from this project could reach nearly 28 million metric tons per year. But FERC refuses to take the straightforward next step of applying the social cost of greenhouse gas values to those quantified tons. In the Midcontinent DEIS, FERC implies that it does not monetize the effects of the project's downstream emissions because, while "[t]he GHG emissions from the downstream end-use of the products transported by the MOSHIP Project would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to climate change that produces the impacts previously described," FERC "cannot determine the MOSHIP Project's incremental physical impacts on the environment caused by climate change," and therefore, "cannot determine whether the project's contribution to cumulative impacts on climate change would be significant."[45]

While there may not be a bright-line test for significance, the emissions FERC estimates for this project are clearly significant and warrant monetization. This is especially true since, once emissions have been

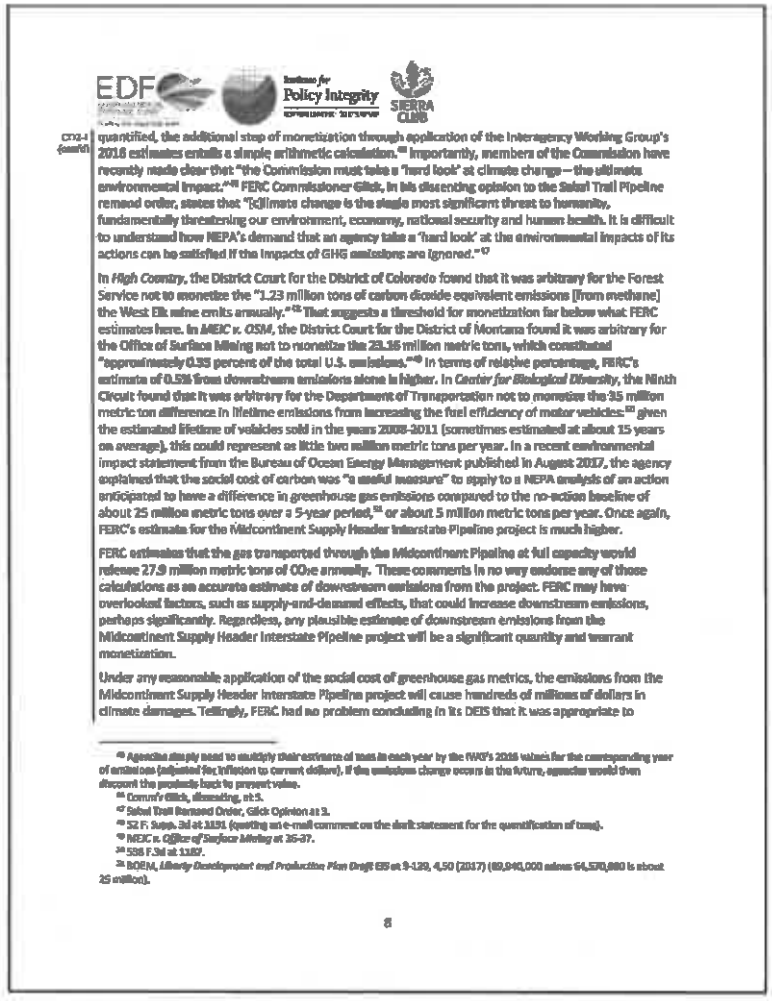
[42] DEIS at 4-187. *But see* Sabal Remand Order at 48 ("[W]e accept that the Social Cost of Carbon methodology does constitute a tool that can be used to estimate incremental physical climate change impacts.").

[43] Sabal Trail Remand Order, Comm'r LaFleur dissent at 2. *See also* Comm'r LaFleur, dissenting in part, at 4 (SCC "is a scientifically-derived tool to translate tonnage of carbon dioxide or other GHGs to the cost of long-term climate harm.... [W]e are able to estimate what the long-term consequence of a ton of carbon dioxide emissions is likely to be, by use of the Social Cost of Carbon tool."); Comm'r Glick dissent at 8 ("[T]he output from the Social Cost of Carbon tool can serve as an indicator of the climate change impacts ... informing the overall qualitative evaluation under NEPA as well as the public interest balancing under the NGA"; rejecting this tool on grounds that FERC has no tools for determining significance is arbitrary and capricious.).

[44] *Id.* at 491.

[45] DEIS at 4-186.

CO2 --Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

quantified, the additional step of monetization through application of the Interagency Working Group's 2016 estimates entails a simple arithmetic calculation.[46] Importantly, members of the Commission have recently made clear that "the Commission must take a 'hard look' at climate change—the ultimate environmental impact."[47] FERC Commissioner Glick, in his dissenting opinion to the Sabal Trail Pipeline remand order, states that "[c]limate change is the single most significant threat to humanity, fundamentally threatening our environment, economy, national security and human health. It is difficult to understand how NEPA's demand that an agency take a 'hard look' at the environmental impacts of its actions can be satisfied if the impacts of GHG emissions are ignored."[47]

In *High Country*, the District Court for the District of Colorado found that it was arbitrary for the Forest Service not to monetize the "1.23 million tons of carbon dioxide equivalent emissions [from methane] the West Elk mine emits annually."[48] That suggests a threshold for monetization far below what FERC estimates here. In *MEIC v. OSM*, the District Court for the District of Montana found it was arbitrary for the Office of Surface Mining not to monetize the 23.16 million metric tons, which constituted "approximately 0.33 percent of the total U.S. emissions."[49] In terms of relative percentage, FERC's estimate of 0.5% from downstream emissions alone is higher. In *Center for Biological Diversity*, the Ninth Circuit found that it was arbitrary for the Department of Transportation not to monetize the 35 million metric ton difference in lifetime emissions from increasing the fuel efficiency of motor vehicles:[50] given the estimated lifetime of vehicles sold in the years 2008-2011 (sometimes estimated at about 15 years on average), this could represent as little two million metric tons per year. In a recent environmental impact statement from the Bureau of Ocean Energy Management published in August 2017, the agency explained that the social cost of carbon was "a useful measure" to apply to a NEPA analysis of an action anticipated to have a difference in greenhouse gas emissions compared to the no-action baseline of about 25 million metric tons over a 5-year period,[51] or about 5 million metric tons per year. Once again, FERC's estimate for the Midcontinent Supply Header Interstate Pipeline project is much higher.

FERC estimates that the gas transported through the Midcontinent Pipeline at full capacity would release 27.9 million metric tons of CO_2e annually. These comments in no way endorse any of those calculations as an accurate estimate of downstream emissions from the project. FERC may have overlooked factors, such as supply-and-demand effects, that could increase downstream emissions, perhaps significantly. Regardless, any plausible estimate of downstream emissions from the Midcontinent Supply Header Interstate Pipeline project will be a significant quantity and warrant monetization.

Under any reasonable application of the social cost of greenhouse gas metrics, the emissions from the Midcontinent Supply Header Interstate Pipeline project will cause hundreds of millions of dollars in climate damages. Tellingly, FERC had no problem concluding in its DEIS that it was appropriate to

[46] Agencies simply need to multiply their estimate of tons in each year by the IWG's 2016 values for the corresponding year of emissions (adjusted for inflation to current dollars). If the emissions change occurs in the future, agencies would then discount the products back to present value.

[47] Comm'r Glick, dissenting, at 5.

[47] Sabal Trail Remand Order, Glick Opinion at 3.

[48] 52 F. Supp. 3d at 1191 (quoting an e-mail comment on the draft statement for the quantification of tons).

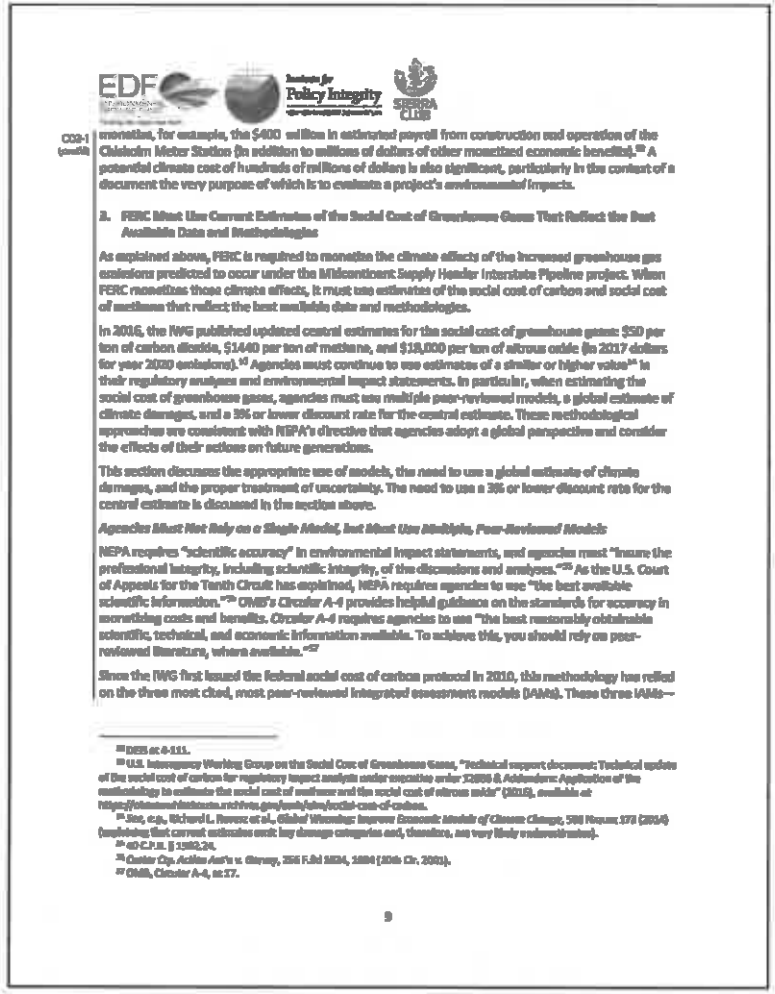
[49] *MEIC v. Office of Surface Mining* at 35-37.

[50] 538 F.3d at 1217.

[51] BOEM, *Liberty Development and Production Plan Draft* EIS at 3-129, 4,50 (2017) (89,940,000 minus 64,570,880 is about 25 million).

8

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

monetize, for example, the $400 million in estimated payroll from construction and operation of the Chisholm Meter Station (in addition to millions of dollars of other monetized economic benefits).[55] A potential climate cost of hundreds of millions of dollars is also significant, particularly in the context of a document the very purpose of which is to evaluate a project's environmental impacts.

2. FERC Must Use Current Estimates of the Social Cost of Greenhouse Gases That Reflect the Best Available Data and Methodologies

As explained above, FERC is required to monetize the climate effects of the increased greenhouse gas emissions predicted to occur under the Midcontinent Supply Header Interstate Pipeline project. When FERC monetizes those climate effects, it must use estimates of the social cost of carbon and social cost of methane that reflect the best available data and methodologies.

In 2016, the IWG published updated central estimates for the social cost of greenhouse gases: $50 per ton of carbon dioxide, $1440 per ton of methane, and $18,000 per ton of nitrous oxide (in 2017 dollars for year 2020 emissions).[56] Agencies must continue to use estimates of a similar or higher value[57] in their regulatory analyses and environmental impact statements. In particular, when estimating the social cost of greenhouse gases, agencies must use multiple peer-reviewed models, a global estimate of climate damages, and a 3% or lower discount rate for the central estimate. These methodological approaches are consistent with NEPA's directive that agencies adopt a global perspective and consider the effects of their actions on future generations.

This section discusses the appropriate use of models, the need to use a global estimate of climate damages, and the proper treatment of uncertainty. The need to use a 3% or lower discount rate for the central estimate is discussed in the section above.

Agencies Must Not Rely on a Single Model, but Must Use Multiple, Peer-Reviewed Models

NEPA requires "scientific accuracy" in environmental impact statements, and agencies must "insure the professional integrity, including scientific integrity, of the discussions and analyses."[58] As the U.S. Court of Appeals for the Tenth Circuit has explained, NEPA requires agencies to use "the best available scientific information."[59] OMB's *Circular A-4* provides helpful guidance on the standards for accuracy in monetizing costs and benefits. *Circular A-4* requires agencies to use "the best reasonably obtainable scientific, technical, and economic information available. To achieve this, you should rely on peer-reviewed literature, where available."[60]

Since the IWG first issued the federal social cost of carbon protocol in 2010, this methodology has relied on the three most cited, most peer-reviewed integrated assessment models (IAMs). These three IAMs—

---

[55] DEIS at 4-111.

[56] U.S. Interagency Working Group on the Social Cost of Greenhouse Gases, "Technical support document: Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866 & Addendum: Application of the methodology to estimate the social cost of methane and the social cost of nitrous oxide" (2016), available at https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2016_update.pdf.

[57] See, e.g., Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates).

[58] 40 C.F.R. § 1502.24.

[59] *Custer Co. Action Ass'n v. Garvey*, 256 F.3d 1024, 1034 (10th Cir. 2001).

[60] OMB, Circular A-4, at 17.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-3 (cont'd)

called DICE (the Dynamic Integrated Model of Climate and the Economy[90]), FUND (the Climate Framework for Uncertainty, Negotiation, and Distribution[91]), and PAGE (Policy Analysis of the Greenhouse Effect[92])—draw on the best available scientific and economic data to link physical impacts to the economic damages of each marginal ton of greenhouse gas emissions. As noted previously, each model translates emissions into changes in atmospheric greenhouse gas concentrations, atmospheric concentrations into temperature changes, and temperature changes into economic damages, which can then be adjusted according to a discount rate. These three models have been combined with inputs derived from peer-reviewed literature on climate sensitivity, socio-economic and emissions trajectories, and discount rates. The results of the three models have been given equal weight in federal agencies' estimates and have been run through statistical techniques like Monte Carlo analysis to account for uncertainty.

In a 2017 report, the National Academies of Sciences (NAS) recommended future improvements to this methodology. Specifically, over the next five years the NAS recommends unbundling the four essential steps in the IAMs into four separate "modules": a socio-economic and emissions scenario module, a climate change module, an economic damage module, and a discount rate module.[93] Unbundling these four steps into separate modules could allow for easier, more transparent updates to each individual component in order to better reflect the best available science and capture the full range of uncertainty in the literature. These four modules could be built from scratch or drawn from the existing IAMs. Either way, the integrated modular framework envisioned by NAS for the future will require significant time and resource commitments from federal agencies.

In the meantime, the NAS has supported the continued near-term use of the existing social cost of greenhouse gas estimates based on the DICE, FUND, and PAGE models, as used by federal agencies to date.[94] In short, DICE, FUND, and PAGE continue to represent the state-of-the-art models. The Government Accountability Office found in 2014 that the estimates derived from these models and used by federal agencies are consensus-based, rely on peer-reviewed academic literature, discuss relevant limitations, and are designed to incorporate new information via public comments and updated research.[95] In fact, the social cost of greenhouse gas estimates used in federal regulatory proposals and EISs have been subject to over 80 distinct public comment periods.[96] The economics literature confirms

[90] William D. Nordhaus, *Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches*, 1 Journal of the Association of Environmental and Resource Economists 1 (2014).

[91] David Anthoff & Richard S.J. Tol, The Climate Framework for Uncertainty, Negotiation and Distribution (FUND), Technical Description, Version 3.5 (2012), *available at* http://www.fund-model.org/versions.

[92] Chris Hope, *The Marginal Impact of CO2 from PAGE2002: An Integrated Assessment Model Incorporating the IPCC's Five Reasons for Concern*, 6 Integrated Assessment J. 19 (2006).

[93] Nat'l Acad. Sci., Eng. & Medicine, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* 3 (2017) [hereinafter "NAS, Second Report"] (recommending an "integrated modular approach").

[94] Specifically, NAS concluded that a near-term update was not necessary or appropriate and the current estimates should continue to be used while future improvements are developed over time. Nat'l Acad. Sci., Eng. & Medicine, *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 1 (2016) [hereinafter "NAS, First Report"].

[95] Gov't Accountability Office, *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates* (2014).

[96] Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017), at Appendix A.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

that estimates based on these three IAMs remain the best available estimates.[65] In 2016, the U.S. Court of Appeals for the Seventh Circuit held the estimates used to date by agencies are reasonable.[66] Just last month, the District of Montana rejected an agency's Environmental Assessment for failure to incorporate the federal social cost of carbon estimates into its cost-benefit analysis of a proposed mine expansion.[67]

Regardless of Executive Order 13,783's withdrawal of the guidance requiring federal agencies to rely on IWG's technical support documents to estimate the social cost of greenhouse gases, IWG's choice of DICE, FUND, and PAGE, its use of inputs and assumptions, and its statistical analysis still represent the state-of-the-art approach based on the best available, peer-reviewed literature. This approach satisfies both NEPA's and Circular A-4's requirements for information quality and transparency. Therefore, in complying with the Executive Order's instructions to ensure that social cost of greenhouse gas estimates are consistent with Circular A-4, agencies will necessarily have to rely on models like DICE, FUND, and PAGE, to use the same or similar inputs and assumptions as the IWG, and to apply statistical analyses like Monte Carlo.

The unavoidable fact is that DICE, FUND, and PAGE are still the dominant, most peer-reviewed models,[68] and most estimates in the literature continue to rely on those models.[69] Each of these models has been developed over decades of research, and has been subject to rigorous peer review, documented in the published literature. While other models exist, they lack DICE's, FUND's, and PAGE's long history of peer review or exhibit other limitations. For example, the World Bank has created ENVISAGE, which models a more detailed breakdown of market sectors,[70] but unfortunately does not account for non-market impacts and so would omit a large portion of significant climate effects. Models like ENVISAGE are therefore not currently appropriate choices under the criteria of Circular A-4.[71]

An approach based on multiple, peer-reviewed models (like DICE, FUND, and PAGE) is more rigorous and more consistent with Circular A-4 than reliance on a single model or estimate. DICE, FUND, and PAGE each include many of the most significant climate effects, use appropriate discount rates and other

---

[65] *E.g.*, Richard G. Newell et al., *Carbon Market Lessons and Global Policy Outlook*, 343 Science 1316 (2014); Bonnie L. Keeler et al., *The Social Costs of Nitrogen*, 2 Science Advances e1600219 (2016); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others).

[66] *Zero Zone*, 832 F.3d at 679 (7th Cir. 2016) (finding that the agency "acted reasonably" in using global estimates of the social cost of carbon, and that the estimates chosen were not arbitrary or capricious).

[67] *Montana Envtl. Info. Ctr.*, 2017 WL 3480262, at *12-15, 32.

[68] *See* Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 7 (July 2015) ("DICE, FUND, and PAGE are the most widely used and widely cited models in the economic literature that link physical impacts to economic damages for the purposes of estimating the SCC."); *citing* Nat'l Acad. Sci., Eng. & Medicine, *Hidden Cost of Energy: Unpriced Consequences of Energy Production and Use* (2010) ("the most widely used impact assessment models").

[69] R.S. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011); T. Havranek et al., *Selective Reporting and the Social Cost of Carbon*, 51 Energy Econ. 394 (2015).

[70] World Bank, *The Environmental Impact and Sustainability Applied General Equilibrium (ENVISAGE) Model* (2008), available at http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1193838209522/Envisage7b.pdf.

[71] Similarly, Intertemporal Computable Equilibrium System (ICES) does not account for non-market impacts. *See* https://www.cmcc.it/models/ices-intertemporal-computable-equilibrium-system. Other models include CRED, which is worthy of further study for future use. Frank Ackerman, Elizabeth A. Stanton & Ramón Bueno, *CRED: A New Model of Climate and Development*, 85 Ecological Economics 166 (2013). Accounting for omitted impacts more generally, E.A. Stanton, F. Ackerman, R. Bueno, *Reason, Empathy, and Fair Play: The Climate Policy Gap*, (Stockholm Environment Inst. Working Paper 2012-02), find a doubling of the SCC using the CRED model.

11

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

assumptions, address uncertainty, are based on peer-reviewed data, and are transparent.[72] However, each IAM also has its own limitations and is sensitive to its own assumptions. No model fully captures all the significant climate effects.[73] By giving weight to multiple models—as the IWG did—agencies can balance out some of these limitations and produce more robust estimates.[74]

Finally, while agencies should be careful not to cherry-pick a single estimate from the literature, it is noteworthy that various estimates in the literature are consistent with the numbers derived from a weighted average of DICE, FUND, and PAGE—namely, with a central estimate of about $40 per ton of carbon dioxide, and a high-percentile estimate of about $120, for year 2015 emissions (in 2016 dollars, at a 3% discount rate). The latest central estimate from DICE's developers is $87 (at a 3% discount rate);[75] from FUND's developers, $12;[76] and from PAGE's developers, $123, with a high-percentile estimate of $332.[77]

In fact, much of the literature suggests that a central estimate of $40 per ton is a very conservative *underestimate* of the true social cost of carbon. A 2013 meta-analysis of the broader literature found a mean estimate of $39 per ton of carbon dioxide,[78] and a soon-to-be-published update by the same author finds a mean estimate of $108 (at a 3% discount rate).[79] A 2015 meta-analysis—which sought out estimates besides just those based on DICE, FUND, and PAGE—found a mean estimate of $83 per ton of carbon dioxide.[80] Various studies relying on expert elicitation[81] from a large body of climate economists and scientists have found mean estimates of $50 per ton of carbon dioxide,[82] $36-$144 per ton of carbon dioxide,[83] and $80-$100 per ton of carbon dioxide.[84] There is a growing consensus in the literature that even the best existing estimates of the social cost of greenhouse gases may severely underestimate the true marginal cost of climate damages.[85] Overall, a central estimate of $40 per ton of

[72] While sensitivity analysis can address parametric uncertainty within a model, using multiple models helps address structural uncertainty.

[73] *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), https://costofcarbon.org/.

[74] Moore, F., Baldos, U., & Hertel, T. (2017). Economic impacts of climate change on agriculture: a comparison of process-based and statistical yield models. *Environmental Research Letters*.

[75] William Nordhaus, *Revisiting the Social Cost of Carbon*, Proc. Nat'l Acad. Sci. (2017) (estimate a range of $21 to $141).

[76] D. Anthoff & R. Tol, *The Uncertainty about the Social Cost of Carbon: A Decomposition Analysis Using FUND*, 177 Climatic Change 515 (2013).

[77] C. Hope, *The social cost of CO2 from the PAGE09 model*, 39 Economics (2011); C. Hope, *Critical issues for the calculation of the social cost of CO2*, 117 *Climatic Change*, 531 (2013).

[78] R. Tol, *Targets for Global Climate Policy: An Overview*, 57 J. Econ. Dynamics & Control 911 (2013).

[79] R. Tol, *Economic Impacts of Climate Change* (Univ. Sussex Working Paper No. 75-2015, 2015).

[80] S. Nocera et al., *The Economic Impact of Greenhouse Gas Abatement through a Meta-Analysis: Valuation, Consequences and Implications in terms of Transport Policy*, 37 Transport Policy 31 (2015).

[81] Circular A-4, at 42, supports use of expert elicitation as a valuable tool to fill gaps in knowledge.

[82] Scott Holladay & Jason Schwartz, *Economics and Climate Change* 48 (Inst. Policy Integrity Brief, 2015) (directly surveying experts about the SCC).

[83] Peter Howard & Derek Sylvan, *The Economic Climate Sensitivity Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1) (using survey results to calibrate the DICE-2013R damage function).

[84] R. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. No. w22807, 2016) ($80-$100 is the trimmed range of estimates at a 4% discount rate; without trimming of outlier responses, the estimate is $200).

[85] E.g., Howard & Sylvan, *supra* note 83; Pindyck, *supra* note 84. The underestimation results from a variety of factors, including omitted and outdated climate impacts (including ignoring impacts to economic growth and tipping points), simplified utility functions (including ignoring relative prices), and applying constant instead of a declining discount rate. *See* Howard, *supra* note 73; Revesz et al., *supra* note 65; J.C. Van Den Bergh & W.J. Botzen, A Lower Bound to the Social Cost of CO2 Emissions, 4 Nature Climate Change 253 (2014) (proposing $125 per metric ton of carbon dioxide in 2015 dollars, or about $200

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND · Institute for Policy Integrity · SIERRA CLUB

CO2-1 (cont'd) carbon dioxide at a 3% discount rate, with a high-percentile estimate of about $120 for year 2015 emissions, is consistent with the best available literature; if anything, the best available literature supports considerably higher estimates.[illegible]

Similarly, a comparison of international estimates of the social cost of greenhouse gases suggests that a central estimate of $40 per ton of carbon dioxide is a very conservative value. Sweden places the long-term valuation of carbon dioxide at $168 per ton; Germany calculates a "climate cost" of $167 per ton of carbon dioxide in the year 2030; the United Kingdom's "shadow price of carbon" has a central value of $115 by 2030; Norway's social cost of carbon is valued at $104 per ton for year 2030 emissions; and various corporations have adopted internal shadow prices as high as $80 per ton of carbon dioxide.[illegible]

Indeed, a number of our organizations have previously commented on ways in which the IWG's approach could be improved to more accurately reflect the true social cost of greenhouse gases. For instance, the IWG's values should reflect risk aversion and account for the additional price that society is willing to pay to avoid uncertainty around increasingly more severe impacts from climate change.[illegible] In addition, noted Harvard economist Martin Weitzman has observed, the three IAMs assume a relatively smooth upward slope in economic damages even as global climates increase well past critical tipping points. An improved social cost of greenhouse gases could reflect modified damage functions that better address tipping points.[illegible]

For these reasons, the IWG's estimates are very likely to underrepresent the true impact that greenhouse gas emissions have on society, and we strongly encourage further efforts to make those efforts more robust. Nevertheless, the IWG's approach represents the best and most rigorous effort that the U.S. government has engaged in thus far to realistically estimate the social cost of greenhouse gases. As such, agencies must incorporate those values into their rulemaking analyses; simply refusing to monetize the greenhouse gas emissions of their actions, as FERC has done in this case, does not pass legal or technical muster.

A Global Estimate of Climate Damages is Required by NEPA

NEPA contains a provision on "International and National Coordination of Efforts" that broadly requires that "all agencies of the Federal Government *shall* . . . recognize the worldwide and long-range character of environmental problems."[illegible] Using a global social cost of greenhouse gases to analyze and set policy fulfills these instructions. Furthermore, the Act requires agencies to, "where consistent with the foreign

---

in today's dollars, as the lower bound estimate). *See also* F.C. Moore & D.B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 Nature Climate Change 127 (2015) (concluding the SCC may be six times higher after accounting for potential growth impacts of climate change). Accounting for both potential impacts of climate change on economic growth and other omitted impacts, S. Dietz and N. Stern find a two- to seven-fold increase in the SCC. *Endogenous growth, convexity of damage and climate risk: how Nordhaus' framework supports deep cuts in carbon emissions*. 125 *The Economic Journal* 574 (2015).

[illegible] Note that the various estimates cited in the paragraph have not all been converted to standard 2012$, and may not all reflect the same year emissions. Nevertheless, the magnitude of this range suggests that $40 per ton of year 2025 emissions is a conservative estimate.

[illegible] *See* Howard & Schwartz, *supra* note 64, at Appendix B. All these estimates are in 2016$.

[illegible] See, e.g., Howarth, R. B., Gerst, M. D., & Borsuk, M. E., 2014. *Risk mitigation and the social cost of carbon*. Global Environmental Change 24, 123-131.

[illegible] Weitzman, M.L., *GHG Targets as Insurance Against Catastrophic Climate Damages*, National Bureau of Economic Research Working Paper No. 16136, 12-16 (2010).

[illegible] 42 U.S.C. § 4332(2)(F) (emphasis added).

13

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

C32-4 (cont'd)

policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment."[31] By continuing to use the global social cost of greenhouse gases to spur reciprocal foreign actions, federal agencies "lend appropriate support" to the NEPA's goal of "maximize[ing] international cooperation" to protect "mankind's world environment." Furthermore, not only is it consistent with Circular A-4 and best economic practices to estimate the global damages of U.S. greenhouse gas emissions in regulatory analyses and environmental impact statements, but no existing methodology for estimating a "domestic-only" value is reliable, complete, or consistent with Circular A-4.

From 2010 through 2016, federal agencies based their regulatory decision and NEPA reviews on global estimates of the social cost of greenhouse gases. Though agencies often also disclosed a "highly speculative" range that tried to capture exclusively U.S. climate costs, emphasis on a global value was recognized as more accurate given the science and economics of climate change, as more consistent with best economic practices, and as crucial to advancing U.S. strategic goals.[32]

Opponents of climate regulation challenged the global number in court and other forums, and often attempted to use Circular A-4 as support.[33] Specifically, opponents have seized on Circular A-4's instructions to "focus" on effects to "citizens and residents of the United States," while any significant effects occurring "beyond the borders of the United States . . . should be reported separately."[34] Importantly, despite this language and such challenges, the U.S. Court of Appeals for the Seventh Circuit had no trouble concluding that a global focus for the social cost of greenhouse gases was reasonable:

> AMRI and Zero Zone [the industry petitioners] next contend that DOE [the Department of Energy] arbitrarily considered the global benefits to the environment but only considered the national costs. They emphasize that the [statute] only concerns "national energy and water conservation." In the New Standards Rule, DOE did not let this submission go unanswered. It explained that climate change "involves a global externality," meaning that carbon released in the United States affects the climate of the entire world. According to DOE, national energy conservation has global effects, and, therefore, those global effects are an appropriate consideration when looking at a national policy. Further, AMRI and Zero Zone point to no global costs that should have

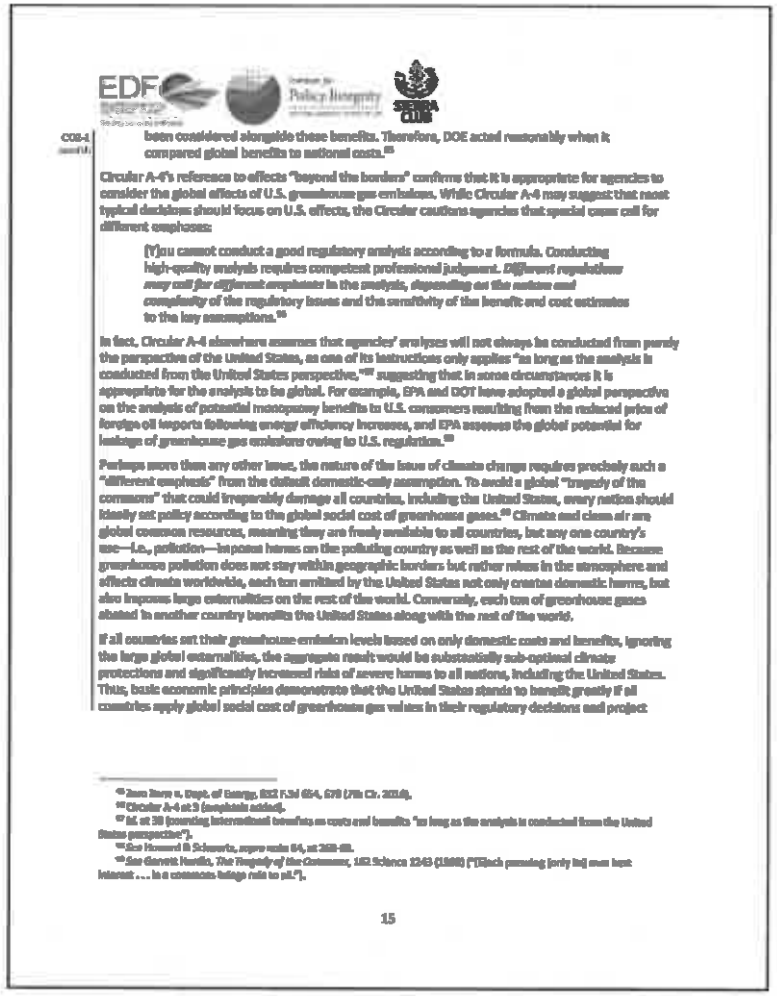
[31] *Id.*; *see also Environmental Defense Fund* v. *Massey*, 986 F.2d 528, 535 (D.C. Cir. 1993) (confirming that Subsection F is mandatory); Natural Resources Defense Council v. NRC, 647 F.2d 1345, 1357 (D.C. Cir. 1981) ("This NEPA prescription, I find, looks toward cooperation, not unilateral action, in a manner consistent with our foreign policy."); *cf.* Council on Environmental Quality, Guidance on NEPA Analyses for Transboundary Impacts (1997), *available at* http://www.gc.noaa.gov/documents/tribnepda.pdf; Exec. Order No. 12,114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 §§ 1-1, 2-1 (Jan. 4, 1979) (applying to "major Federal actions . . . having significant effects on the environment outside the geographical borders of the United States," and enabling agency officials "to be informed of pertinent environmental considerations and to take such considerations into account . . . in making decisions regarding such actions").

[32] *See generally* Howard & Schwartz, *supra* note 64.

[33] Ted Gayer & W. Kip Viscusi, *Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analyses: Domestic versus Global Approaches*, 10 Rev. Envtl. Econ. & Pol'y 245 (2016) (citing Circular A-4 to argue against a global perspective on the social cost of carbon); *see also, e.g.*, Petitioners Brief on Procedural and Record-Based Issues at 70, in West Virginia v. EPA, case 15-1363, D.C. Cir. (filed February 18, 2016) (challenging EPA's use of the global social cost of carbon).

[34] Circular A-4 at 15. Note that A-4 slightly conflates "borne to citizens" with "borders of the United States": U.S. citizens have financial and other interests tied to effects beyond the borders of the United States, as discussed further below.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



been considered alongside these benefits. Therefore, DOE acted reasonably when it compared global benefits to national costs.[85]

Circular A-4's reference to effects "beyond the borders" confirms that it is appropriate for agencies to consider the global effects of U.S. greenhouse gas emissions. While Circular A-4 may suggest that most typical decisions should focus on U.S. effects, the Circular cautions agencies that special cases call for different emphases:

> [Y]ou cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment. *Different regulations may call for different emphases* in the analysis, *depending on the nature and complexity* of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.[86]

In fact, Circular A-4 elsewhere assumes that agencies' analyses will not always be conducted from purely the perspective of the United States, as one of its instructions only applies "as long as the analysis is conducted from the United States perspective,"[87] suggesting that in some circumstances it is appropriate for the analysis to be global. For example, EPA and DOT have adopted a global perspective on the analysis of potential monopsony benefits to U.S. consumers resulting from the reduced price of foreign oil imports following energy efficiency increases, and EPA assesses the global potential for leakage of greenhouse gas emissions owing to U.S. regulation.[88]

Perhaps more than any other issue, the nature of the issue of climate change requires precisely such a "different emphasis" from the default domestic-only assumption. To avoid a global "tragedy of the commons" that could irreparably damage all countries, including the United States, every nation should ideally set policy according to the global social cost of greenhouse gases.[89] Climate and clean air are global common resources, meaning they are freely available to all countries, but any one country's use—i.e., pollution—imposes harms on the polluting country as well as the rest of the world. Because greenhouse pollution does not stay within geographic borders but rather mixes in the atmosphere and affects climate worldwide, each ton emitted by the United States not only creates domestic harms, but also imposes large externalities on the rest of the world. Conversely, each ton of greenhouse gases abated in another country benefits the United States along with the rest of the world.

If all countries set their greenhouse emission levels based on only domestic costs and benefits, ignoring the large global externalities, the aggregate result would be substantially sub-optimal climate protections and significantly increased risks of severe harms to all nations, including the United States. Thus, basic economic principles demonstrate that the United States stands to benefit greatly if all countries apply global social cost of greenhouse gas values in their regulatory decisions and project

[85] Zero Zone v. Dept. of Energy, 832 F.3d 654, 678 (7th Cir. 2016).
[86] Circular A-4 at 3 (emphasis added).
[87] Id. at 38 (counting international benefits as costs and benefits "as long as the analysis is conducted from the United States perspective").
[88] See Howard & Schwartz, *supra* note 84, at 268-69.
[89] See Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243 (1968) ("[E]ach herding family brings forward its own best interest . . . In a commons brings ruin to all.").

15

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

reviews. Indeed, the United States stands to gain hundreds of billions or even trillions of dollars in direct benefits from efficient foreign action on climate change.[100]

In order to ensure that other nations continue to use global social cost of greenhouse gas values, it is important that the United States itself continue to do so.[101] The United States is engaged in a repeated strategic dynamic with several significant players—including the United Kingdom, Germany, Sweden, and others—that have already adopted a global framework for valuing the social cost of greenhouse gases.[102] For example, Canada and Mexico have explicitly borrowed the IWG's global SCC metric to set their own fuel efficiency standards.[103] For the United States to now depart from this collaborative dynamic by reverting to a domestic-only estimate would undermine the country's long-term interests and could jeopardize emissions reductions underway in other countries, which are already benefiting the United States.

For these and other reasons, the IWG properly relied on global estimates to develop its SCC metric, and many federal agencies have since relied on this global metric to evaluate and justify their decisions. At the same time, some agencies have, in addition to the global estimate, also disclosed a "highly speculative" estimate of the domestic-only effects of climate change. In particular, the Department of Energy always includes a chapter on a domestic-only value of carbon emissions in the economic analyses supporting its energy efficiency standards; EPA has also often disclosed similar estimates.[104] Such an approach is consistent with Circular A-4's suggestion that agencies should usually disclose domestic effects separately from global effects. However, as we have discussed, reliance on a domestic-only methodology would be inconsistent with both the inherent nature of climate change and the standards of Circular A-4. Consequently, it is appropriate under Circular A-4 for agencies to continue to rely on global estimates of the social cost of greenhouses to justify their regulatory decisions or their choice of alternatives under NEPA.

Moreover, no current methodology can accurately estimate a "domestic-only" value of the social cost of greenhouse gases. OMB, the National Academies of Sciences, and the economic literature all agree that existing methodologies for calculating a "domestic-only" value of the social cost of greenhouse gases are deeply flawed and result in severe and misleading underestimates. In developing the social cost of carbon, the IWG did offer some such domestic estimates. Using the results of one economic model (FUND) as well as the U.S. share of global gross domestic product (GDP), the group generated an "approximate, provisional, and *highly speculative*" range of 7–23% of the global social cost of carbon as an estimate of the purely direct climate effects to the United States.[105] Yet, as the IWG itself acknowledged, this range is almost certainly an underestimate because it ignores significant, indirect

[100] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* (2015), http://policyintegrity.org/files/publications/ForeignAction_DomesticWindfall.pdf

[101] See Robert Axelrod, *The Evolution of Cooperation* 10-11 (1984) (on repeated prisoner's dilemma games).

[102] See Howard & Schwartz, *supra* note 64, at Appendix B.

[103] See Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24, 147 Can. Gazette pt. II, 459, 544 [Can.], *available at* http://canadagazette.gc.ca/rp-pr/p2/2013/2013-03-13/html/sor-dors24-eng.html ("The values used by Environment Canada are based on the extensive work of the U.S. Interagency Working Group on the Social Cost of Carbon."); Jason Furman & Brian Deese, *The Economic Benefits of a 50 Percent Target for Clean Energy Generation by 2025*, White House Blog, June 29, 2016 (summarizing the North American Leader's Summit announcement that U.S., Canada, and Mexico would "align" their SCC estimates).

[104] Howard & Schwartz, *supra* note 64, at 228-31.

[105] Interagency Working Group on Social Cost of Carbon, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12,866 at 11 (2010) (emphasis added).

16

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

costs to trade, human health, and security that are likely to "spill over" into the United States as other regions experience climate change damages, among other effects.[109]

Neither the existing IAMs nor a share of global GDP are appropriate bases for calculating a domestic-only estimate. The IAMs were never designed to calculate a domestic SCC, since a global SCC is the economic efficient value. FUND, like other IAMS, includes some simplifying assumptions: of relevance, FUND and the other IAMs are not able to capture the adverse effects that the impacts of climate change in other countries will have on the United States through trade linkages, national security, migration, and other forces.[110] This is why the IWG characterized the domestic-only estimate from FUND as a "highly speculative" underestimate. Similarly, a domestic-only estimate based on some rigid conception of geographic borders or U.S. share of world GDP will fail to capture all the climate-related costs and benefits that matter to U.S. citizens.[111] U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. GDP is a "monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time."[112] GDP therefore does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism,[113] or even the 8 million Americans living abroad.[114] At the same time, GDP is also over-inclusive, counting productive operations in the United States that are owned by foreigners. Gross National Income (GNI), by contrast, defines its scope not by location but by ownership interests.[115] However, not only has GNI fallen out of favor as a metric used in international economic policy,[116] but using a domestic-only SCC based on GNI would make the SCC metrics incommensurable with other costs in regulatory impact analyses, since most regulatory costs are calculated by U.S. agencies regardless of whether they fall to U.S.-owned entities or to foreign-owned entities operating in the United States.[117] Furthermore, both GDP and GNI are dependent on what happens in other countries, due to trade and the international flow of capital. The artificial constraints of both metrics counsel against a rigid split based on either U.S. GDP or U.S. GNI.[118]

[109] *Id.* (explaining that the IAMs, like FUND, do "not account for how damages in other regions could affect the United States (e.g., global migration, economic and political instability effects)").

[110] *See, e.g.*, Dept. of Defense, *National Security Implications of Climate-Related Risks and a Changing Climate* (2015), available at https://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery.

[111] A domestic-only SCC would fail to "provide to the public and to OMB a careful and transparent analysis of the anticipated consequences of economically significant regulatory actions." Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011).

[112] Tim Callen, *Gross Domestic Product: An Economy's All*, IMF, http://www.imf.org/external/pubs/ft/fandd/basics/gdp.htm (last updated Mar. 28, 2012).

[113] "U.S. residents spend millions each year on foreign travel, including travel to places that are at substantial risk from climate change, such as European cities like Venice and tropical destinations like the Caribbean islands." David A. Dana, *Holiday Foreign Lives and Civilization in Cost-Benefit Analysis: The Case of the United States and Climate Change Policy* (Northwestern Faculty Working Paper 186, 2009), http://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1185&context=facultyworkingpapers.

[114] Assoc. of Americans Resident Overseas, https://www.aaro.org/about-aaro/the-americans-abroad. Admittedly 8 million is only 0.11% of the total population living outside the United States.

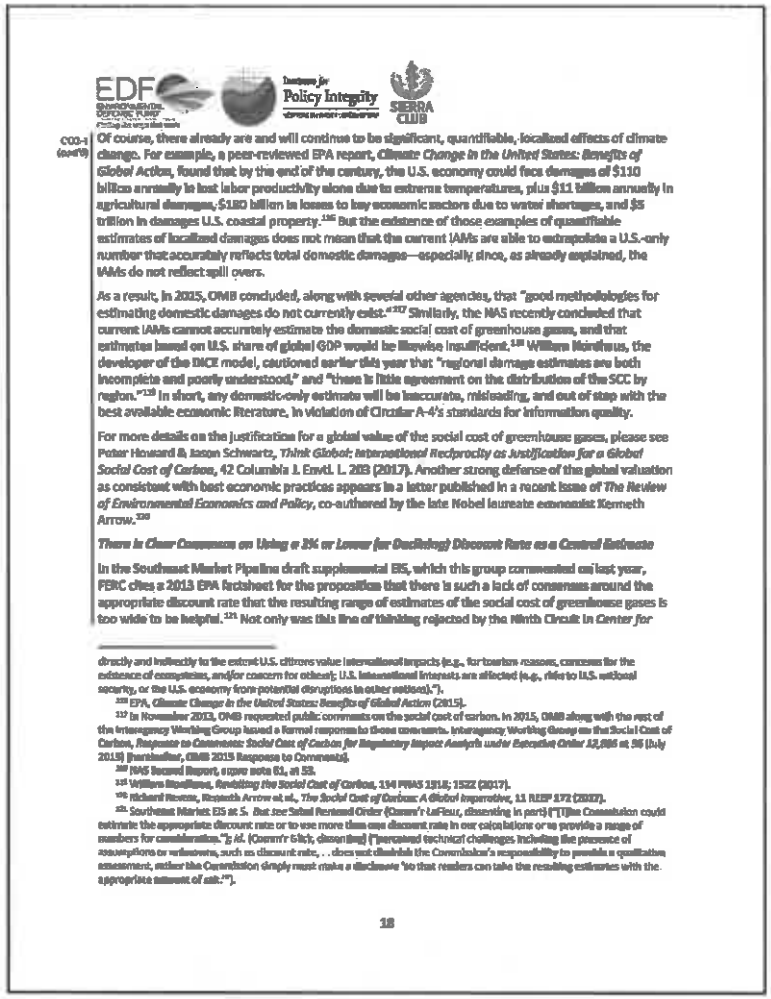
[115] *GNI, Atlas Method (Current US$)*, The World Bank, http://data.worldbank.org/indicator/NY.GNP.ATLS.CD.

[116] *Id.*

[117] U.S. Office of Management and Budget & Secretariat General of the European Commission, *Review of Application of EU and US Regulatory Impact Assessment Guidelines on the Analysis of Impacts on International Trade and Development* 11 (2006).

[118] Advanced Notice of Proposed Rulemaking on Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,415 (July 30, 2008) ("Furthermore, international effects of climate change may also affect domestic benefits

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

Of course, there already are and will continue to be significant, quantifiable, localized effects of climate change. For example, a peer-reviewed EPA report, *Climate Change in the United States: Benefits of Global Action*, found that by the end of the century, the U.S. economy could face damages of $110 billion annually in lost labor productivity alone due to extreme temperatures, plus $11 billion annually in agricultural damages, $180 billion in losses to key economic sectors due to water shortages, and $5 trillion in damages U.S. coastal property.[115] But the existence of those examples of quantifiable estimates of localized damages does not mean that the current IAMs are able to extrapolate a U.S.-only number that accurately reflects total domestic damages—especially since, as already explained, the IAMs do not reflect spill overs.

As a result, in 2015, OMB concluded, along with several other agencies, that "good methodologies for estimating domestic damages do not currently exist."[117] Similarly, the NAS recently concluded that current IAMs cannot accurately estimate the domestic social cost of greenhouse gases, and that estimates based on U.S. share of global GDP would be likewise insufficient.[118] William Nordhaus, the developer of the DICE model, cautioned earlier this year that "regional damage estimates are both incomplete and poorly understood," and "there is little agreement on the distribution of the SCC by region."[119] In short, any domestic-only estimate will be inaccurate, misleading, and out of step with the best available economic literature, in violation of Circular A-4's standards for information quality.

For more details on the justification for a global value of the social cost of greenhouse gases, please see Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017). Another strong defense of the global valuation as consistent with best economic practices appears in a letter published in a recent issue of *The Review of Environmental Economics and Policy*, co-authored by the late Nobel laureate economist Kenneth Arrow.[120]

There Is Clear Consensus on Using a 3% or Lower for Declining Discount Rate as a Central Estimate

In the Southeast Market Pipeline draft supplemental EIS, which this group commented on last year, FERC cites a 2013 EPA factsheet for the proposition that there is such a lack of consensus around the appropriate discount rate that the resulting range of estimates of the social cost of greenhouse gases is too wide to be helpful.[121] Not only was this line of thinking rejected by the Ninth Circuit in *Center for*

directly and indirectly to the extent U.S. citizens value international impacts (e.g., for tourism reasons, concern for the existence of ecosystems, and/or concern for others); U.S. international interests are affected (e.g., relate to U.S. national security, or the U.S. economy from potential disruptions in other nations).").

[115] EPA, *Climate Change in the United States: Benefits of Global Action* (2015).

[117] In November 2013, OMB requested public comments on the social cost of carbon. In 2015, OMB along with the rest of the Interagency Working Group issued a formal response to those comments. Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 36 (July 2015) [hereinafter, OMB 2015 Response to Comments].

[118] NAS Second Report, supra note 61, at 53.

[119] William Nordhaus, *Revisiting the Social Cost of Carbon*, 114 PNAS 1518, 1522 (2017).

[120] Richard Revesz, Kenneth Arrow et al., *The Social Cost of Carbon: A Global Imperative*, 11 REEP 172 (2017).

[121] Southeast Market EIS at 5. *But see* Solar Revised Order (Comm'r LaFleur, dissenting in part) ("[T]he Commission could estimate the appropriate discount rate or to use more than one discount rate in our calculations or to provide a range of numbers for consideration."); *id.* (Comm'r Glick, dissenting) ("perceived technical challenges including the presence of assumptions or unknowns, such as discount rate, . . . does not diminish the Commission's responsibility to provide a qualitative assessment, either the Commission simply must make a disclosure 'so that readers can take the resulting estimates with the appropriate amount of salt.'").

18

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

Biological Diversity—"while . . . there is a range of values, the value of carbon emissions reduction is certainly not zero"[121]—but the range of values recommended by the Interagency Working Group[122] and endorsed by the National Academies of Sciences[123] is rather manageable. In 2015, the IWG recommended values at discount rates from 2.5% to 5%, calculated as between $12 and $62 for year 2020 emissions.[124] Numerous federal agencies have had no difficulty either applying this range in their environmental impact statements or else focusing on the central estimate at a 3% discount rate.[125] Most recently, in August 2017, the Bureau of Ocean Energy Management applied the IWG's range of estimates calculated at three discount rates (2.5%, 3%, and 5%) to its environmental impact statement for an offshore oil development plan,[126] and called this range of estimates "a useful measure to assess the benefits of CO_2 reductions and inform agency decisions."[127]

More importantly, there is widespread consensus that a central estimate calculated at a 3% or lower discount rate, or else using a declining discount rate, is most appropriate, while a 7% discount rate would be wholly inappropriate in the context of intergenerational climate damages. Because of the long lifespan of greenhouse gases and the long-term or irreversible consequences of climate change, the effects of today's emissions changes will stretch out over the next several centuries. The time horizon for an agency's analysis of climate effects, as well as the discount rate applied to future costs and benefits, determines how an agency treats future generations. Current central estimates of the social cost of greenhouse gases are based on a 3% discount rate and a 300-year time horizon. Executive Order 13,783 disbanded the Interagency Working Group in March 2017 and instructs agencies to reconsider the "appropriate discount rates" when monetizing the value of climate effects.[128] By citing the official guidance on typical regulatory impact analyses (namely, Circular A-4), the Order implicitly called into question the IWG's choice not to use a 7% discount rate. However, use of a 7% discount would not only be inconsistent with best economic practices but would violate NEPA's required consideration of impacts on future generations.

NEPA requires agencies to weigh the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity," as well as "any irreversible and

---

[121] 538 F.3d at 1208.

[122] See Interagency Working Group on the Social Cost of Greenhouse Gases, *Technical Update* (2016) (hereinafter 2016 TSD).

[123] See National Academies of Sciences, *Assessment of Approaches to Updating the Social Cost of Carbon* (2016) (hereinafter First NAS Report) (endorsing continued near-term use of the IWG numbers; in 2017, the NAS recommended moving to a declining discount rate, see National Academies of Sciences, *Valuing Climate Damages* (2017) (hereinafter Second NAS Report).

[124] 2016 TSD. The values given here are in 2007$. The IWG also recommended a 95th percentile value of $123.

[125] BLM, Envtl. Assessment—*Waste Prevention, Prod. Subject to Royalties, and Res. Conservation* at 52 (2016); BLM, *Final Envtl. Assessment: Little Willow Creek Protective Oil and Gas Lease*, DOI-BLM-ID-B010-2014-0008-EA, at 82 (2015); Office of Surface Mining, *Final Envtl. Impact Statement—Four Corners Power Plant and Navajo Mine Energy Project* at 4.2-26 to 4.2-27 (2013) (explaining the social cost of greenhouse gases "provide[s] further context and enhance[s] the discussion of climate change impacts in the NEPA analysis."); U.S. Army Corps of Engineers, *Draft Envtl. Impact Statement for the Missouri River Recovery Mgmt. Project* at 3-333 (2016); U.S. Forest Serv., *Fishlake-Manti La Sal National Forests Travel Management Plan Supplemental Final Envtl. Impact Statement* at 120-125 (Dec. 2016) (using both the social cost of carbon and social cost of methane estimates in cost benefit); NHTSA EIS, *Available at* https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/cafe_fels_feis_0.pdf at 9-77.

[126] BOEM, *Liberty Development Project: Draft Supplemental Impact Statement*, at 4-347 (2017).

[127] *Id.* at 4-329.

[128] Executive Order 13,783 § 5(c).

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

Irretrievable commitments of resources."[130] That requirement is prefaced with a congressional declaration of policy that explicitly references the needs of future generations:

> The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment . . . declares that it is the continuing policy of the Federal Government . . . to use all practicable means and measures . . . to create and maintain conditions under which men and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.[131]

When the Congressional Conference Committee adopted that language, it reported that the first "broad national goal" under the statute is to "fulfill the responsibilities of each generation as trustee of the environment for future generations. It is recognized in this [congressional] statement [of policy] that each generation has a responsibility to improve, enhance, and maintain the quality of the environment *to the greatest extent possible for the continued benefit of future generations*."[132]

Because applying a 7% discount rate to the social cost of greenhouse gases could drop the valuation essentially to $0, use of such a rate effectively ignores the needs of future generations. Doing so would arbitrarily fail to consider an important statutory factor that Congress wrote into the NEPA requirements.

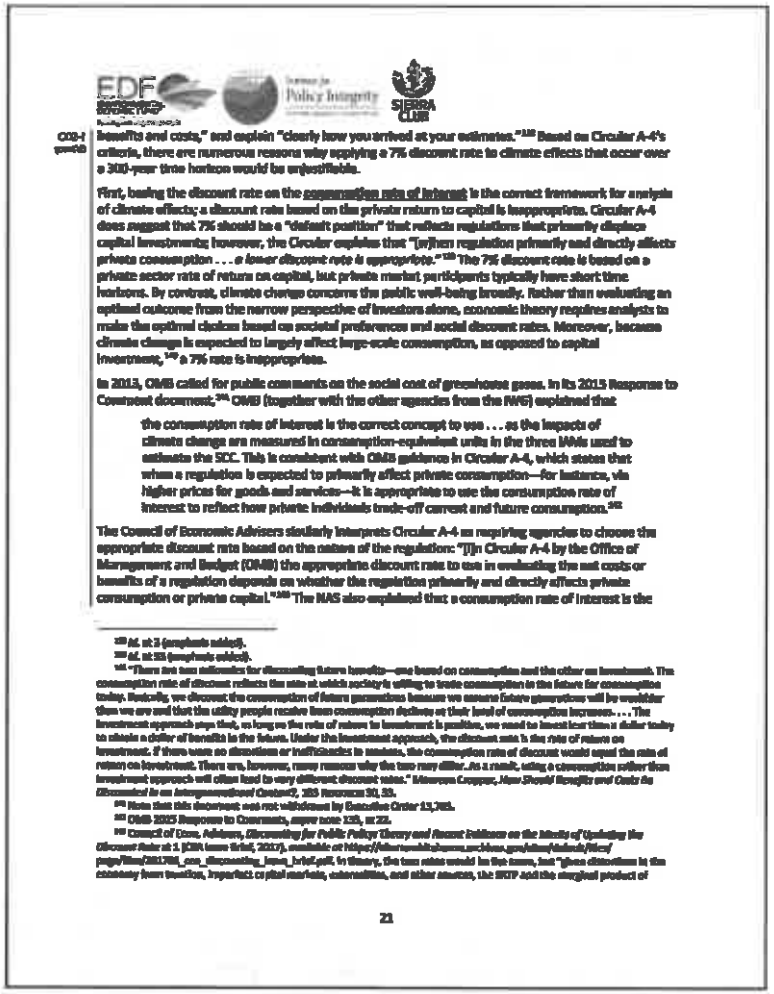
Moreover, a 7% discount rate is inconsistent with best economic practices, including under Circular A-4. In 2015, OMB explained that "Circular A-4 is a *living document*. . . . [T]he use of *7 percent is not considered appropriate* for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself."[133] While Circular A-4 tells agencies generally to use a 7% discount rate in addition to lower rates for typical rules,[134] the guidance does not intend for default assumptions to produce analyses inconsistent with best economic practices. Circular A-4 clearly supports using lower rates to the exclusion of a 7% rate for the costs and benefits occurring over the extremely long, 300-year time horizon of climate effects.

Circular A-4 clearly requires agency analysts to do more than rigidly apply default assumptions: "You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment."[135] As such, analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[136] and agencies must "*follow sound and defensible* values or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[137] Rather than assume a 7% discount rate should be applied automatically to every analysis, Circular A-4 requires agencies to justify the choice of discount rates for each analysis: "[S]tate in your report what assumptions were used, *such as . . . the discount rates* applied to future

[130] 42 U.S.C. § 4332(2)(C).
[131] 42 U.S.C.A. § 4331.
[132] See 115 Cong. Rec. 40419 (1969) (emphasis added); *see also* same in Senate Report 91-296 (1969).
[133] Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 38 (July 2015) (hereinafter, OMB 2015 Response to Comments).
[134] Circular A-4 at 36 ("For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent....If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.").
[135] *Id.* at 5.
[136] *Id.* at 17.
[137] *Id.* at 27 (emphasis added).

20

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-I cont'd

benefits and costs," and explain "clearly how you arrived at your estimates."[128] Based on Circular A-4's criteria, there are numerous reasons why applying a 7% discount rate to climate effects that occur over a 300-year time horizon would be unjustifiable.

First, basing the discount rate on the consumption rate of interest is the correct framework for analysis of climate effects; a discount rate based on the private return to capital is inappropriate. Circular A-4 does suggest that 7% should be a "default position" that reflects regulations that primarily displace capital investments; however, the Circular explains that "[w]hen regulation primarily and directly affects private consumption . . . *a lower discount rate is appropriate*."[129] The 7% discount rate is based on a private sector rate of return on capital, but private market participants typically have short time horizons. By contrast, climate change concerns the public well-being broadly. Rather than evaluating an optimal outcome from the narrow perspective of investors alone, economic theory requires analysts to make the optimal choices based on societal preferences and social discount rates. Moreover, because climate change is expected to largely affect large-scale consumption, as opposed to capital investment,[130] a 7% rate is inappropriate.

In 2013, OMB called for public comments on the social cost of greenhouse gases. In its 2015 Response to Comment document,[131] OMB (together with the other agencies from the IWG) explained that

> the consumption rate of interest is the correct concept to use . . . as the impacts of climate change are measured in consumption-equivalent units in the three IAMs used to estimate the SCC. This is consistent with OMB guidance in Circular A-4, which states that when a regulation is expected to primarily affect private consumption—for instance, via higher prices for goods and services—it is appropriate to use the consumption rate of interest to reflect how private individuals trade-off current and future consumption.[132]

The Council of Economic Advisers similarly interprets Circular A-4 as requiring agencies to choose the appropriate discount rate based on the nature of the regulation: "[I]n Circular A-4 by the Office of Management and Budget (OMB) the appropriate discount rate to use in evaluating the net costs or benefits of a regulation depends on whether the regulation primarily and directly affects private consumption or private capital."[133] The NAS also explained that a consumption rate of interest is the

[128] *Id.* at 3 (emphasis added).

[129] *Id.* at 33 (emphasis added).

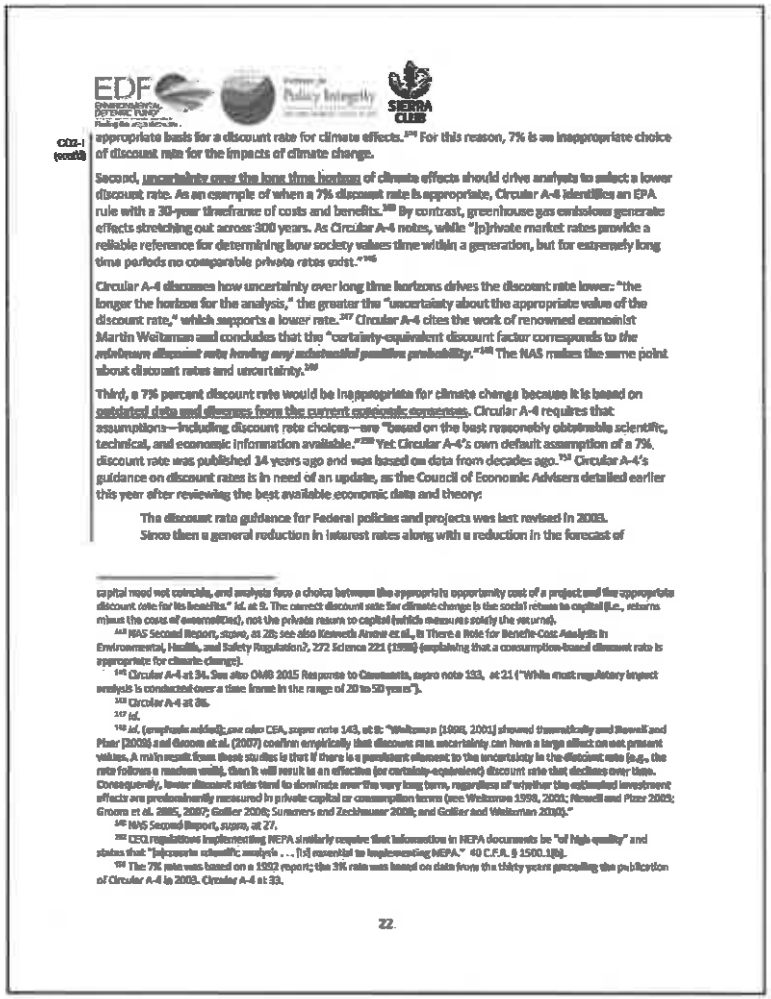
[130] "There are two rationales for discounting future benefits—one based on consumption and the other on investment. The consumption rate of discount reflects the rate at which society is willing to trade consumption in the future for consumption today. Basically, we discount the consumption of future generations because we assume future generations will be wealthier than we are and that the utility people receive from consumption declines as their level of consumption increases. . . . The investment approach says that, as long as the rate of return to investment is positive, we need to invest one dollar today to obtain a dollar of benefits in the future. Under the investment approach, the discount rate is the rate of return on investment. If there were no distortions or inefficiencies in markets, the consumption rate of discount would equal the rate of return on investment. There are, however, many reasons why the two may differ. As a result, using a consumption rather than investment approach will often lead to very different discount rates." Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 169 Resources 30, 33.

[131] Note that this document was not withdrawn by Executive Order 13,783.

[132] OMB 2015 Response to Comments, *supra* note 128, at 22.

[133] Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* at 1 (CEA issue brief, 2017), *available at* https://obamawhitehouse.archives.gov/sites/default/files/page/files/20170106_cea_discounting_issue_brief.pdf. In theory, the two rates would be the same, but "given distortions in the economy from taxation, imperfect capital markets, externalities, and other sources, the SRTP and the marginal product of

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-I (cont'd)

appropriate basis for a discount rate for climate effects."[144] For this reason, 7% is an inappropriate choice of discount rate for the impacts of climate change.

Second, uncertainty over the long time horizon of climate effects should drive analysts to select a lower discount rate. As an example of when a 7% discount rate is appropriate, Circular A-4 identifies an EPA rule with a 30-year timeframe of costs and benefits.[145] By contrast, greenhouse gas emissions generate effects stretching out across 300 years. As Circular A-4 notes, while "[p]rivate market rates provide a reliable reference for determining how society values time within a generation, but for extremely long time periods no comparable private rates exist."[146]

Circular A-4 discusses how uncertainty over long time horizons drives the discount rate lower: "the longer the horizon for the analysis," the greater the "uncertainty about the appropriate value of the discount rate," which supports a lower rate.[147] Circular A-4 cites the work of renowned economist Martin Weitzman and concludes that the "certainty-equivalent discount factor corresponds to the *minimum discount rate having any substantial positive probability*."[148] The NAS makes the same point about discount rates and uncertainty.[149]

Third, a 7% percent discount rate would be inappropriate for climate change because it is based on outdated data and diverges from the current economic consensus. Circular A-4 requires that assumptions—including discount rate choices—are "based on the best reasonably obtainable scientific, technical, and economic information available."[150] Yet Circular A-4's own default assumption of a 7% discount rate was published 14 years ago and was based on data from decades ago.[151] Circular A-4's guidance on discount rates is in need of an update, as the Council of Economic Advisers detailed earlier this year after reviewing the best available economic data and theory:

> The discount rate guidance for Federal policies and projects was last revised in 2003. Since then a general reduction in interest rates along with a reduction in the forecast of

---

capital need not coincide, and analysts face a choice between the appropriate opportunity cost of a project and the appropriate discount rate for its benefits." Id. at 9. The correct discount rate for climate change is the social return to capital (i.e., returns minus the costs of externalities), not the private return to capital (which measures solely the returns).

[144] NAS Second Report, supra, at 28; see also Kenneth Arrow et al., Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?, 272 Science 221 (1996) (explaining that a consumption-based discount rate is appropriate for climate change).

[145] Circular A-4 at 34. See also OMB 2015 Response to Comments, supra note 133, at 21 ("While most regulatory impact analysis is conducted over a time frame in the range of 20 to 50 years").

[146] Circular A-4 at 35.

[147] Id.

[148] Id. (emphasis added); see also CEA, supra note 143, at 8: "Weitzman (1998, 2001) showed theoretically and Newell and Pizer (2003) and Groom et al. (2007) confirm empirically that discount rate uncertainty can have a large effect on net present values. A main result from these studies is that if there is a persistent element to the uncertainty in the discount rate (e.g., the rate follows a random walk), then it will result in an effective (or certainty-equivalent) discount rate that declines over time. Consequently, lower discount rates tend to dominate over the very long term, regardless of whether the estimated investment effects are predominantly measured in private capital or consumption terms (see Weitzman 1998, 2001; Newell and Pizer 2003; Groom et al. 2005, 2007; Gollier 2008; Summers and Zeckhauser 2008; and Gollier and Weitzman 2010)."

[149] NAS Second Report, supra, at 27.

[150] CEQ regulations implementing NEPA similarly require that information in NEPA documents be "of high quality" and states that "[a]ccurate scientific analysis . . . [is] essential to implementing NEPA." 40 C.F.R. § 1500.1(b).

[151] The 7% rate was based on a 1992 report; the 3% rate was based on data from the thirty years preceding the publication of Circular A-4 in 2003. Circular A-4 at 33.

22

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

long-run interest rates, warrants serious consideration for a reduction in the discount rates used for benefit-cost analysis.[232]

In addition to recommending a value below 7% as the discount factor based on private capital returns, the Council of Economic Advisers further explains that, because long-term interest rates have fallen, a discount rate based on the consumption rate of interest "should be at most 2 percent,"[233] which further confirms that applying a 7% rate to a context like climate change would be wildly out of step with the latest data and theory. Similarly, recent expert elicitations—a technique supported by Circular A-4 for filling in gaps in knowledge[234]—indicate that a growing consensus among experts in climate economics for a discount rate between 2% and 3%; 5% represents the upper range of values recommended by experts, and few to no experts support discount rates greater than 5% being applied to the costs and benefits of climate change.[235] Tellingly, none of the integrated assessment models (DICE, FUND, and PAGE) used to build the IWG's estimates of the social cost of greenhouse gases uses a 7% discount rate. Based on current economic data and theory, the most appropriate discount rate for climate change is 3% or lower.

Fourth, Circular A-4 requires more of analysts than giving all possible assumptions and scenarios equal attention in a sensitivity analysis: If alternate assumptions would fundamentally change the decision, Circular A-4 requires analysts to select the most reasonable assumptions from the sensitivity analysis.

Circular A-4 indicates that significant intergenerational effects will warrant a special sensitivity analysis focused on discount rates even lower than 3%:

> Special ethical considerations arise when comparing benefits and costs across generations. . . . It may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. . . . If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.[237]

Elsewhere in Circular A-4, OMB clarifies that sensitivity analysis should not result in a rigid application of all available assumptions regardless of plausibility. Circular A-4 instructs agencies to depart from default assumptions when special issues "call for different emphases" depending on "the sensitivity of the benefit and cost estimates to the key assumptions."[238] More specifically:

---

[232] CEA, *supra* note 143, at 1; *Id.* at 9 ("In general the evidence supports lowering these discount rates, with a plausibly best guess based on the available information being that the lower discount rate should be at most 2 percent while the upper discount rate should also likely be reduced."); *Id.* at 6 ("The Congressional Budget Office, the Blue Chip consensus forecasts, and the Administration forecasts all place the ten year treasury yield at less than 4 percent in the future, while at the same time forecasting CPI inflation at 2.3 or 2.4 percent per year. The implied real ten year Treasury yield is then below 2 percent in all these forecasts.").

[233] *Id.* at 1.

[234] Circular A-4 at 43.

[235] Peter Howard & Derek Sylan, *The Climate Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1); M.A. Drupp, et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2018) (finding consensus on social discount rates between 1-3%).

[236] Circular A-4 at 35-36.

[237] *Id.* at 3.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

> If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out *sensitivity analyses using plausible alternative assumptions*. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine *which of the alternative assumptions is more appropriate*.[150]

In other words, if using a 7% discount rate would fundamentally change the agency's decision compared to using a 3% or lower discount rate, the agency must evaluate which assumption is most appropriate. Since OMB, the Council of Economic Advisers, the National Academies of Sciences, and the economic literature all conclude that a 7% rate is inappropriate for climate change, agencies should select a 3% or lower rate. Applying a 7% rate to climate effects cannot be justified "based on the best reasonably obtainable scientific, technical, and economic information available" and is inconsistent with the proper treatment of uncertainty over long time horizons.

Finally, to the extent there is uncertainty around the discount rate over long periods of time, the growing economic consensus supports shifting to a declining discount rate framework. Circular A-4 contemplates the use of declining discount rates in its reference to the work of Weitzman.[151] As the Council of Economic Advisers explained earlier this year, Weitzman and others developed the foundation for a declining discount rate approach, wherein rates start relatively higher for near-term costs and benefits but steadily decline over time according to a predetermined schedule until, in the very long-term, very low rates dominate due to uncertainty.[152] The National Academies of Sciences' report also strongly endorses a declining discount rate approach due to uncertainty.[153] In other words, the rational response to a concern about uncertainty over the discount rate is not to abandon the social cost of greenhouse gas methodology, but to apply declining discount rates and to treat the estimates calculated at a constant 3% rate as conservative lower-bound estimates.

One possible schedule of declining discount rates was proposed by Weitzman.[154] It is derived from a broad survey of top economists and other climate experts and explicitly incorporates arguments around interest rate uncertainty. Work by Arrow *et al*, Cropper *et al*, and Gollier and Weitzman, among others,

[150] *Id.* at 42 (emphasis added).

[151] Circular A-4, at page 36, cites to Weitzman's chapter in Portney & Weyant, eds. (1999); that chapter, at page 28, recommends a declining discount rate approach: "a sliding-scale social discounting strategy" with the rate at 3-4% through year 25; then around 2% until year 75; then around 1% until year 300; and then 0% after year 300.

[152] CEA, *supra* note 143, at 9 ("[A]nother way to incorporate uncertainty when discounting the benefits and costs of policies and projects that accrue in the far future—applying discount rates that decline over time. This approach uses a higher discount rate initially, but then applies a graduated schedule of lower discount rates further out in time. The first argument is based on the application of the Ramsey framework in a stochastic setting (Gollier 2013), and the second is based on Weitzman's 'expected net present value' approach (Weitzman 1998, Gollier and Weitzman 2010). In light of these arguments, the governments of the United Kingdom and France apply declining discount rates to their official public project evaluations.").

[153] NAS Second Report, *supra*.

[154] Martin L. Weitzman, Gamma Discounting, 91 Am. Econ. Rev. [illegible]. Weitzman's schedule is as follows:

1-5 years	6-25	26-75	76-300	300+ years
4%	3%	2%	1%	0%

24

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

similarly argue for a declining interest rate schedule and lay out the fundamental logic.[183] Another schedule of declining discount rates has been adopted by the United Kingdom.[184]

The technical appendix on discounting attached to these comments more thoroughly reviews the various schedules of declining discount rates available for agencies to select and explains why agencies not only can but should adopt a declining discount framework to address uncertainty. An additional technical appendix on uncertainty explains in detail why uncertainty around the social cost of greenhouse gas points toward higher values. Shifting to a declining discount rate framework would increase the social cost of greenhouse gases.[185] Consequently, a central estimate calculated at 3% should be considered a lower-bound of the social cost of greenhouse gases. But even providing a lower-bound estimate of the social cost of greenhouse gases helps inform decisionmakers and the public, and FERC is required by NEPA to provide some monetization of climate damages, consistent with economic best practices.

Similarly, a 300-year time horizon is required by best economic practices. In 2017, the National Academies of Sciences issued a report stressing the importance of a longer time horizon for calculating the social cost of greenhouse gases. The report states that, "[i]n the context of the socioeconomic, damage, and discounting assumptions, the time horizon needs to be long enough to capture the vast majority of the present value of damages."[186] The report goes on to note that the length of the time horizon is dependent "on the rate at which undiscounted damages grow over time and on the rate at which they are discounted. Longer time horizons allow for representation and evaluation of longer-run geophysical system dynamics, such as sea level change and the carbon cycle."[187] In other words, after selecting the appropriate discount rate based on theory and data (in this case, 3% or below), analysts should determine the time horizon necessary to capture all costs and benefits that will have important net present values at the discount rate. Therefore, a 3% or lower discount rate for climate change implies the need for a 300-year horizon to capture all significant values. NAS reviewed the best available, peer-reviewed scientific literature and concluded that the effects of greenhouse gas emissions over a 300-year period are sufficiently well established and reliable as to merit consideration in estimates of the social cost of greenhouse gases.[188]

Agencies Should Follow the Social Cost of Greenhouse Gas Protocol's Treatment of Uncertainty

[183] Kenneth J. Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 Science 349 (2013); Kenneth J. Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis?*, Rev Environ Econ Policy 8 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, Am Econ Rev Papers Proc 1 (2014); Christian Gollier & Martin L. Weitzman, *How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?* 107 Economics Letters 3 (2010).

[184] Joseph Lowe, H.M. Treasury, U.K., Intergenerational Wealth Transfers and Social Discounting: Supplementary Green Book Guidance 3 (2008), available at http://www.hm-treasury.gov.uk/d/4(3).pdf. The U.K. declining discount rate schedule that [illegible] values is as follows:

0-30	31-75	76-125	126-200	201-300	301+ years
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.00%	2.57%	2.14%	1.71%	1.29%	[illegible]

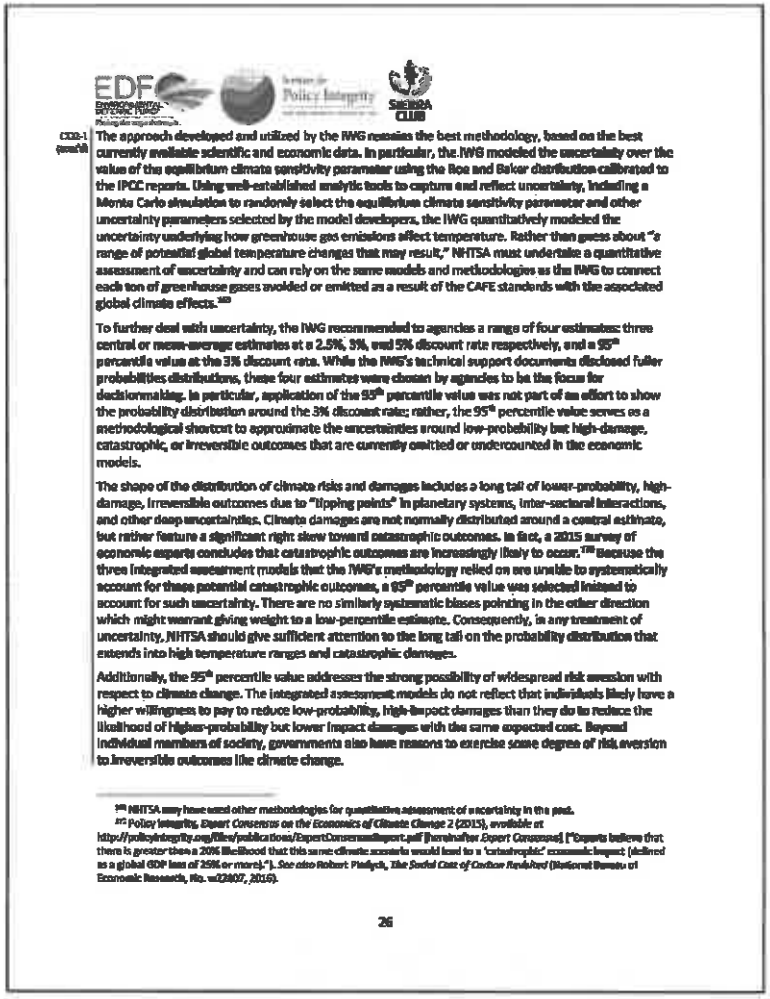
[185] This assumes the use of reasonable values in the Ramsey equation. But in general, as compared to a constant discount rate, a declining rate approach should decrease the effective discount rate.

[186] NAS Second Report, *supra* note 61, at 28.

[187] *Id.*

[188] NAS First Report, *supra* note 62, at 32.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

The approach developed and utilized by the IWG remains the best methodology, based on the best currently available scientific and economic data. In particular, the IWG modeled the uncertainty over the value of the equilibrium climate sensitivity parameter using the Roe and Baker distribution calibrated to the IPCC reports. Using well-established analytic tools to capture and reflect uncertainty, including a Monte Carlo simulation to randomly select the equilibrium climate sensitivity parameter and other uncertainty parameters selected by the model developers, the IWG quantitatively modeled the uncertainty underlying how greenhouse gas emissions affect temperature. Rather than guess about "a range of potential global temperature changes that may result," NHTSA must undertake a quantitative assessment of uncertainty and can rely on the same models and methodologies as the IWG to connect each ton of greenhouse gases avoided or emitted as a result of the CAFE standards with the associated global climate effects.[169]

To further deal with uncertainty, the IWG recommended to agencies a range of four estimates: three central or mean-average estimates at a 2.5%, 3%, and 5% discount rate respectively, and a 95th percentile value at the 3% discount rate. While the IWG's technical support documents disclosed fuller probabilities distributions, these four estimates were chosen by agencies to be the focus for decisionmaking. In particular, application of the 95th percentile value was not part of an effort to show the probability distribution around the 3% discount rate; rather, the 95th percentile value serves as a methodological shortcut to approximate the uncertainties around low-probability but high-damage, catastrophic, or irreversible outcomes that are currently omitted or undercounted in the economic models.

The shape of the distribution of climate risks and damages includes a long tail of lower-probability, high-damage, irreversible outcomes due to "tipping points" in planetary systems, inter-sectoral interactions, and other deep uncertainties. Climate damages are not normally distributed around a central estimate, but rather feature a significant right skew toward catastrophic outcomes. In fact, a 2015 survey of economic experts concludes that catastrophic outcomes are increasingly likely to occur.[170] Because the three integrated assessment models that the IWG's methodology relied on are unable to systematically account for these potential catastrophic outcomes, a 95th percentile value was selected instead to account for such uncertainty. There are no similarly systematic biases pointing in the other direction which might warrant giving weight to a low-percentile estimate. Consequently, in any treatment of uncertainty, NHTSA should give sufficient attention to the long tail on the probability distribution that extends into high temperature ranges and catastrophic damages.

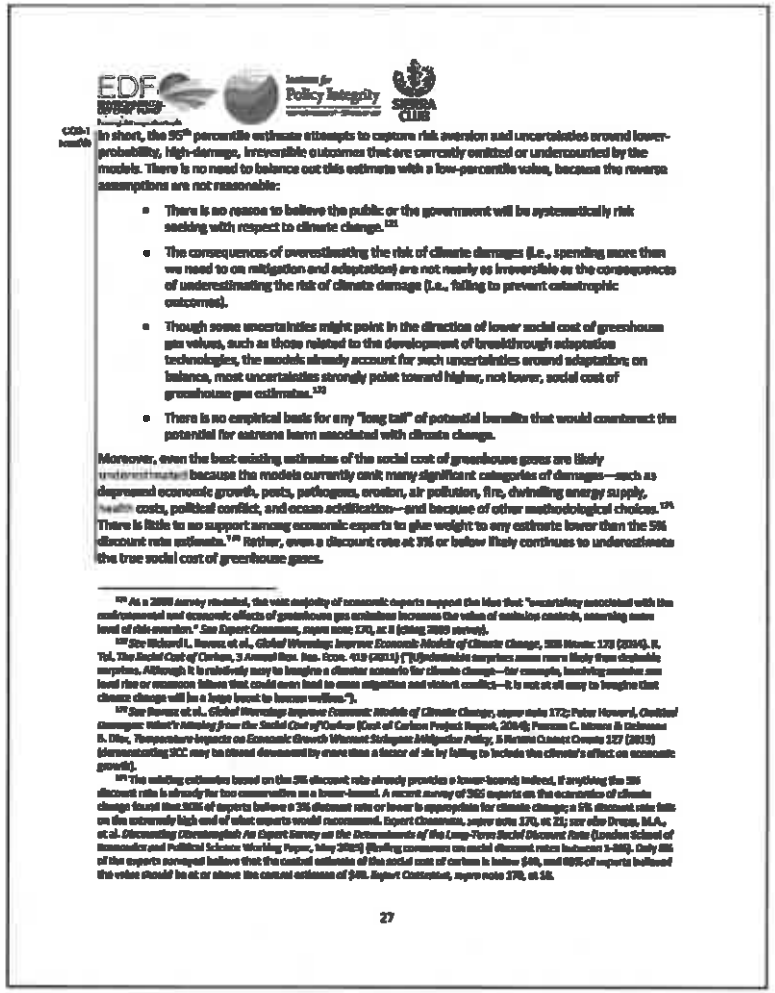
Additionally, the 95th percentile value addresses the strong possibility of widespread risk aversion with respect to climate change. The integrated assessment models do not reflect that individuals likely have a higher willingness to pay to reduce low-probability, high-impact damages than they do to reduce the likelihood of higher-probability but lower impact damages with the same expected cost. Beyond individual members of society, governments also have reasons to exercise some degree of risk aversion to irreversible outcomes like climate change.

[169] NHTSA may have used other methodologies for quantitative assessment of uncertainty in the past.

[170] Policy Integrity, *Expert Consensus on the Economics of Climate Change* 2 (2015), *available at* http://policyintegrity.org/files/publications/ExpertConsensusReport.pdf [hereinafter *Expert Consensus*] ["Experts believe that there is greater than a 20% likelihood that this same climate scenario would lead to a 'catastrophic' economic impact (defined as a global GDP loss of 25% or more)."). *See also* Robert Pindyck, *The Social Cost of Carbon Revisited* (National Bureau of Economic Research, No. w22807, 2016).

26

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

In short, the 95th percentile estimate attempts to capture risk aversion and uncertainties around lower-probability, high-damage, irreversible outcomes that are currently omitted or undercounted by the models. There is no need to balance out this estimate with a low-percentile value, because the reverse assumptions are not reasonable:

- There is no reason to believe the public or the government will be systematically risk seeking with respect to climate change.[121]
- The consequences of overestimating the risk of climate damages (i.e., spending more than we need to on mitigation and adaptation) are not nearly as irreversible as the consequences of underestimating the risk of climate damage (i.e., failing to prevent catastrophic outcomes).
- Though some uncertainties might point in the direction of lower social cost of greenhouse gas values, such as those related to the development of breakthrough adaptation technologies, the models already account for such uncertainties around adaptation; on balance, most uncertainties strongly point toward higher, not lower, social cost of greenhouse gas estimates.[122]
- There is no empirical basis for any "long tail" of potential benefits that would counteract the potential for extreme harm associated with climate change.

Moreover, even the best existing estimates of the social cost of greenhouse gases are likely [illegible] because the models currently omit many significant categories of damages—such as depressed economic growth, pests, pathogens, erosion, air pollution, fire, dwindling energy supply, [illegible] costs, political conflict, and ocean acidification—and because of other methodological choices.[123] There is little to no support among economic experts to give weight to any estimate lower than the 5% discount rate estimate.[124] Rather, even a discount rate at 3% or below likely continues to underestimate the true social cost of greenhouse gases.

---

[121] As a 2009 survey revealed, the vast majority of economic experts support the idea that "uncertainty associated with the environmental and economic effects of greenhouse gas emissions increases the value of emissions controls, meaning some level of risk aversion." *See Expert Consensus*, *supra* note 170, at 2 (citing 2009 survey).

[122] *See* Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014); R. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011) ("[U]ncertainty comprises more costs than benefits."). Although it is relatively easy to imagine a climate scenario for climate change—for example, involving modest sea level rise or monsoon failure that could even lead to some migration and violent conflict—it is not at all easy to imagine that climate change will be a huge boost to human welfare.").

[123] *See* Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, *supra* note 172; Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014); Frances C. Moore & Delavane B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 Nature Climate Change 127 (2015) (demonstrating IGC may be biased downward by more than a factor of six by failing to include the climate's effect on economic growth).

[124] The existing estimates based on the 5% discount rate already provides a lower-bound; indeed, if anything the 5% discount rate is already far too conservative as a lower-bound. A recent survey of 365 experts on the economics of climate change found that 80% of experts believe a 3% discount rate or lower is appropriate for climate change; a 5% discount rate falls on the extremely high end of what experts would recommend. Expert Consensus, *supra* note 170, at 21; *see also* Drupp, M.A., et al. *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%). Only 8% of the experts surveyed believe that the central estimate of the social cost of carbon is below $40, and 69% of experts believed the value should be at or above the current estimate of $40. *Expert Consensus*, *supra* note 170, at 16.

27

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

The National Academies of Sciences did recommend that the IWG document its full treatment of uncertainty in an appendix and disclose low-probability as well as high-probability estimates of the social cost of greenhouse gases.[175] However, that does not mean it would be appropriate for individual agencies to rely on low-percentile estimates to justify decisions. While disclosing low-percentile estimates as a sensitivity analysis may promote transparency, relying on such an estimate for decisionmaking—in the face of contrary guidance from the best available science and economics on uncertainty and risk—would not be a "credible, objective, realistic, and scientifically balanced" approach to uncertainty.

More generally, agencies in general—and FERC in this particular instance—should remember that uncertainty is not a reason to abandon the social cost of greenhouse gas methodologies; quite the contrary uncertainty supports higher estimates of the social cost of greenhouse gases, because most uncertainties regarding climate change entail tipping points, catastrophic risks, and unknown unknowns about the damages of climate change. Because the key uncertainties of climate change include the risk of irreversible catastrophes, applying an options value framework to the regulatory context strengthens the case for ambitious regulatory action to reduce greenhouse gas emissions. There are numerous well-established, rigorous analytical tools available to help agencies characterize and quantitatively assess uncertainty, such as Monte Carlo simulations, and the IWG's social cost of greenhouse gas protocol incorporates those tools. For more details, please see the attached technical appendix on uncertainty.

Sincerely,

Ely Benson, Staff Attorney, Sierra Club

Susanne Brooks, Director of U.S. Climate Policy and Analysis, Environmental Defense Fund

Tomás Carbonell, Senior Attorney and Director of Regulatory Policy, Environmental Defense Fund

Denise Grab, Western Regional Director, Institute for Policy Integrity, NYU School of Law*

Peter H. Howard, Ph.D., Economic Director, Institute for Policy Integrity, NYU School of Law*

Illana Paul, Policy Associate, Institute for Policy Integrity, NYU School of Law*

Richard L. Revesz, Director, Institute for Policy Integrity, NYU School of Law*

Martha Roberts, Senior Attorney, Environmental Defense Fund

Jason A. Schwartz, Legal Director, Institute for Policy Integrity, NYU School of Law*

Jeffrey Shrader, Economics Fellow, Institute for Policy Integrity, NYU School of Law*

Peter Zalzal, Director of Special Projects and Senior Attorney, Environmental Defense Fund

For any questions regarding these comments, please contact jason.schwartz@nyu.edu.

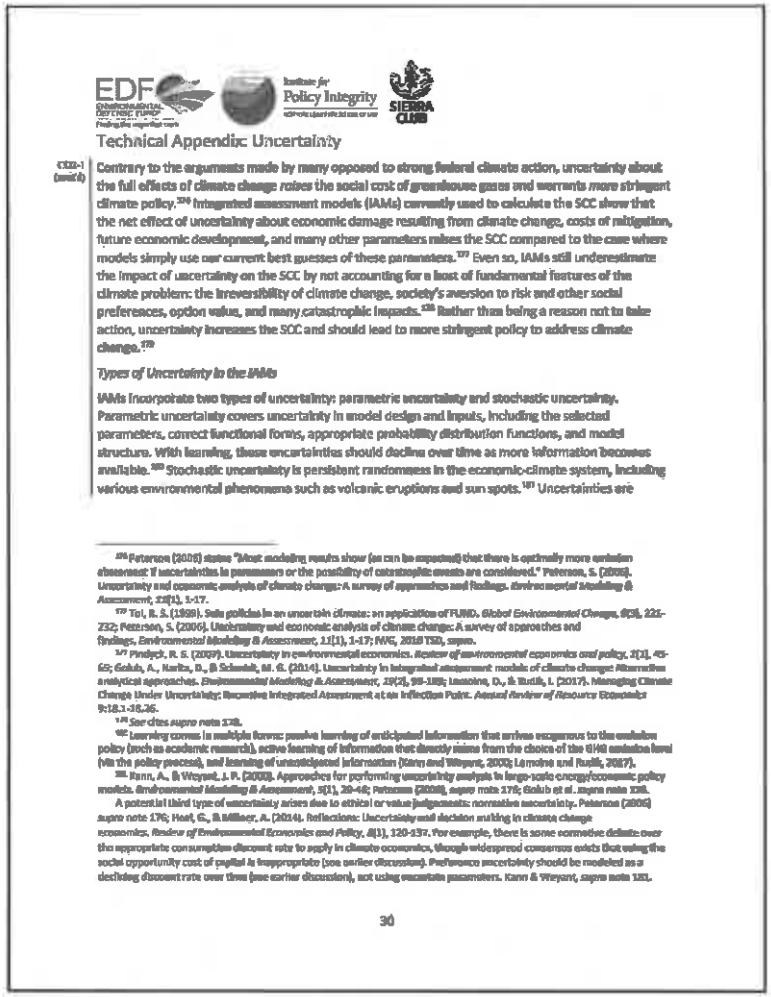
* No part of this document purports to present New York University School of Law's views, if any.

[175] Nat'l Acad. Of Sci., *Assessment of Approaches to Updating the Social Cost of Carbon* 49 (2016) ("[T]he IWG could identify a high percentile (e.g., 90th, 95th) and corresponding low percentile (e.g., 10th, 5th) of the SCC frequency distributions on each grade.").

28

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



Technical Appendix: Uncertainty

CEQ-1 (cont'd)

Contrary to the arguments made by many opposed to strong federal climate action, uncertainty about the full effects of climate change *raises* the social cost of greenhouse gases and warrants *more* stringent climate policy.[176] Integrated assessment models (IAMs) currently used to calculate the SCC show that the net effect of uncertainty about economic damage resulting from climate change, costs of mitigation, future economic development, and many other parameters raises the SCC compared to the case where models simply use our current best guesses of these parameters.[177] Even so, IAMs still underestimate the impact of uncertainty on the SCC by not accounting for a host of fundamental features of the climate problem: the irreversibility of climate change, society's aversion to risk and other social preferences, option value, and many catastrophic impacts.[178] Rather than being a reason not to take action, uncertainty increases the SCC and should lead to more stringent policy to address climate change.[179]

Types of Uncertainty in the IAMs

IAMs incorporate two types of uncertainty: parametric uncertainty and stochastic uncertainty. Parametric uncertainty covers uncertainty in model design and inputs, including the selected parameters, correct functional forms, appropriate probability distribution functions, and model structure. With learning, these uncertainties should decline over time as more information becomes available.[180] Stochastic uncertainty is persistent randomness in the economic-climate system, including various environmental phenomena such as volcanic eruptions and sun spots.[181] Uncertainties are

[176] Peterson (2006) states "[M]ost modeling results show (as can be expected) that there is optimally more emission abatement if uncertainties in parameters or the possibility of catastrophic events are considered." Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, 11(1), 1-17.

[177] Tol, R. S. (1999). Safe policies in an uncertain climate: an application of FUND. *Global Environmental Change*, 9(3), 221-232; Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, 11(1), 1-17; IWG, 2010 TSD, *supra*.

[178] Pindyck, R. S. (2009). Uncertainty in environmental economics. *Review of environmental economics and policy*, 3(1), 45-65; Golub, A., Narita, D., & Schmidt, M. G. (2014). Uncertainty in integrated assessment models of climate change: Alternative analytical approaches. *Environmental Modeling & Assessment*, 19(2), 99-113; Lemoine, D., & Traeger, C. (2017). Managing Climate Change Under Uncertainty: Recursive Integrated Assessment at an Inflection Point. *Annual Review of Resource Economics* 9:18.1-18.26.

[179] See cites *supra* note 178.

[180] Learning comes in multiple forms: passive learning of anticipated information that arrives exogenous to the evolution policy (such as academic research), active learning of information that directly stems from the choice of the GHG emission level (via the policy process), and learning of unanticipated information (Kann and Weyant, 2000; Lemoine and Rudik, 2017).

[181] Kann, A., & Weyant, J. P. (2000). Approaches for performing uncertainty analysis in large-scale energy/economic policy models. *Environmental Modeling & Assessment*, 5(1), 29-46; Peterson (2006), *supra* note 176; Golub et al., *supra* note 178.

A potential third type of uncertainty arises due to ethical or value judgments: normative uncertainty. Peterson (2006) *supra* note 176; Heal, G., & Millner, A. (2014). Reflections: Uncertainty and decision making in climate change economics. *Review of Environmental Economics and Policy*, 8(1), 120-137. For example, there is some normative debate over the appropriate consumption discount rate to apply in climate economics, though widespread consensus exists that using the social opportunity cost of capital is inappropriate (see earlier discussion). Preference uncertainty should be modeled as a declining discount rate over time (see earlier discussion), not using uncertain parameters. Kann & Weyant, *supra* note 181.

30

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

present in each component of the IAMs: socio-economic scenarios, the simple climate model, the damage and abatement cost functions, and the social welfare function (including the discount rate).[202]

When modeling climate change uncertainty, scientists and economists have long emphasized the importance of accounting for the potential of catastrophic climate change.[203] Catastrophic outcomes combine several overlapping concepts including unlucky states of the world (i.e., bad draws), deep uncertainty, and climate tipping points and elements.[204] Traditionally, IAM developers address uncertainty by specifying probability distributions over various climate and economic parameters. This type of uncertainty implies the possibility of an especially bad draw if multiple uncertain parameters turn out to be lower than we expect, causing actual climate damages to greatly exceed expected damages.

Our understanding of the climate and economic systems is also affected by so-called "deep uncertainty," which can be thought of as uncertainty over the true probability distributions for specific climate and economic parameters.[205] The mean and variance of many uncertain climate phenomena are unknown due to lack of data, resulting in "fat-tailed distributions"—i.e., the tail of the distributions declines to zero slower than the normal distribution. Fat-tailed distributions result when the best guess of the distribution is derived under learning.[206] Given the general opinion that bad surprises are likely to outweigh good surprises in the case of climate change,[207] modelers capture deep uncertainty by selecting probability distributions with a fat upper tail which reflects the greater likelihood of extreme events.[208] The possibility of fat tails increases the likelihood of a "very" bad draw with high economic costs, and can result in a very high (and potentially infinite) expected cost of climate change (a phenomenon known as the dismal theory).[209]

Climate tipping elements are environmental thresholds where a small change in climate forcing can lead to large, non-linear shifts in the future state of the climate (over short and long periods of time) through positive feedback (i.e., snowball) effects.[210] Tipping points refer to economically relevant thresholds

[202] Peterson (2006), *supra* note 176; Pindyck (2007), *supra* note 178; Heal & Millner, *supra* note 181.

[203] Nordhaus, W. D. (2008). *A question of balance: Weighing the options on global warming policies*. Yale University Press; Kopp, R. E., Shwom, R. L., Wagner, G., & Yuan, J. (2016). Tipping elements and climate–economic shocks: Pathways toward integrated assessment. *Earth's Future*, *4*(8), 346-372.

[204] Kopp et al. (2016), *supra* note 183.

[205] *Id.*

[206] Nordhaus, W. D. (2009). An Analysis of the Dismal Theorem (No. 1686). Cowles Foundation Discussion Paper; Weitzman, M. L. (2011). Fat-tailed uncertainty in the economics of catastrophic climate change. *Review of Environmental Economics and Policy*, *5*(2), 275-292; Pindyck, R. S. (2011). Fat tails, thin tails, and climate change policy. *Review of Environmental Economics and Policy*, *5*(2), 258-274.

[207] Ackerman, F., & Stanton, E. A. (2008). Climate risks and carbon prices: revising the social cost of carbon. *Economics: The Open-Access, Open-Assessment E-Journal*, *6*(2012-10), 1; Tol, R. S. (2012). On the uncertainty about the total economic impact of climate change. *Environmental and Resource Economics*, *53*(1), 97-116.

[208] Weitzman (2011), *supra* note 186, notes that "deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with expertly calibrated downside fatality on possible planetary damages. This is a recipe for producing what are called 'fat tails' in the extremes of critical probability distributions."

[209] Weitzman, M. L. (2009). On modeling and interpreting the economics of catastrophic climate change. *The Review of Economics and Statistics*, *91*(1), 1-19; Nordhaus (2009), *supra* note 186; Weitzman (2011), *supra* note 186.

[210] Tipping elements are characterized by: (1) deep uncertainty, (2) absence from climate models, (3) large modeling changes relative to the initial change crossing the relevant threshold, and (4) irreversibility. Kopp et al. (2016), *supra* note 183.

31

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND | Institute for Policy Integrity | SIERRA CLUB

CO2-1 (cont'd) after which change occurs rapidly (i.e., Gladwellian tipping points), such that opportunities for adaptation and intervention are limited.[191] Tipping point examples include the reorganization of the Atlantic meridional overturning circulation (AMOC) and a shift to a more persistent El Niño regime in the Pacific Ocean.[192] Social tipping points—including climate-induced migration and conflict—also exist. These various tipping points interact, such that triggering one tipping point may affect the probabilities of triggering other tipping points.[193] There is some overlap between tipping point events and fat tails in that the probability distributions for how likely, how quick, and how damaging tipping points will be are unknown.[194] Accounting fully for these most pressing, and potentially most dramatic, uncertainties in the climate-economic system matter because humans are risk averse and tipping points—like many other aspects of climate change—are, by definition, irreversible

How IAMs and the IWG Account for Uncertainty

Currently, IAMs (including all of those used by the IWG) capture uncertainty in two ways: deterministically and through uncertainty propagation. For the deterministic method, the modeler assumes away uncertainty (and thus the possibility of bad draws and fat tails) by setting parameters equal to their most likely (median) value. Using these values, the modeler calculates the median SCC value. Typically, the modeler conducts sensitivity analysis over key parameters—one at a time or jointly—to determine the robustness of the modeling results. This is the approach employed by Nordhaus in the preferred specification of the DICE model[195] used by the IWG.

Uncertainty propagation is most commonly carried out using Monte Carlo simulation. In these simulations, the modeler randomly draws parameter values from each of the model's probability distributions, calculates the SCC for the draw, and then repeats this exercise thousands of times to calculate a mean social cost of carbon.[196] Tol, Anthoff, and Hope employ this technique in FUND and PAGE—as did the IWG (2010, 2013, and 2016)—by specifying probability distributions for the climate and economic parameters in the models. These models are especially helpful for assessing the net effect of different parametric and stochastic uncertainties. For instance, both the costs of mitigation and the damage from climate change are uncertain. Higher costs would warrant less stringent climate policies,

---

[191] *Id.*

[192] *Id.*; Kriegler, E., Hall, J. W., Held, H., Dawson, R., & Schellnhuber, H. J. (2009). Imprecise probability assessment of tipping points in the climate system. *Proceedings of the national Academy of Sciences*, 106(13), 5041-5046; Kleo, D., & Keller, K. (2016). A potential disintegration of the West Antarctic Ice Sheet: Implications for economic analyses of climate policy. *The American Economic Review*, 106(5), 607-611. See Table 1 of Kopp et al. (2016) *supra* note 183, for a full list of known tipping elements and points.

[193] Kriegler et al. (2009), *supra* note 192; Cai, Y., Lenton, T. M., & Lontzek, T. S. (2016). Risk of multiple interacting tipping points should encourage rapid CO2 emission reduction; Kopp et al. (2016) *supra* note 183.

[194] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/; Kopp et al. (2016) *supra* note 183.

[195] Nordhaus, W. & Sztorc, P. (2013). DICE 2013: Introduction & User's Manual. Retrieved from Yale University, Department of Economics website: http://www.econ.yale.edu/~nordhaus/homepage/documents/DICEmanualfull

[196] In alternative calculation method, the modeler "performs optimization of polices for a large number of possible parameter combinations individually and estimates their probability weighted sum." Golub et al. *supra* note 178. In more recent DICE-2016, Nordhaus conducts a three parameter analysis using this method to determine a SCC confidence interval. Given that PAGE and FUND model hundred(s) of uncertainty parameters, this methodology appears limited in the number of uncertain variables that can be easily specified.

32.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-I (cont'd)

while higher damages lead to more stringent policy, so theoretically, the effect of these two factors on climate policy could be ambiguous. Uncertainty propagation in an IAM calibrated to empirically motivated distributions, however, shows that climate damage uncertainty outweighs the effect of cost uncertainty, leading to a stricter policy when uncertainty is taken into account than when it is ignored.[107] This can be seen in the resulting right-skewed distribution of the SCC (see Figure 1 in IWG (2016)) where the mean (Monte Carlo) SCC value clearly exceeds the median (deterministic) SCC value.

The IWG was rigorous in addressing uncertainty. First, it conducted Monte Carlo simulations over the above IAMs specifying different possible outcomes for climate sensitivity (represented by a right skewed, fat tailed distribution to capture the potential of higher than expected warming). It also used scenario analysis: five different emissions growth scenarios and three discount rates. Second, the IWG (2016) reported the various moments and percentiles—including the 95th percentile—of the resulting SCC estimates. Third, the IWG put in place an updating process, e.g., the 2013 and 2016 updates, which updates the models as new information becomes available.[108] As such, the IWG used the various tools that economists have developed over time to address the uncertainty inherent in estimating the economic cost of pollution: reporting various measures of uncertainty, using Monte Carlo simulations, and updating estimates as evolving research advances our knowledge of climate change. Even so, the IWG underestimates the SCC by failing to capture key features of the climate problem.

Current IAMs Underestimate the SCC by Failing to Sufficiently Model Uncertainty

Given the current treatment of uncertainty by the IWG (2016) and the three IAMs that they employ, the IWG (2016) estimates represent an underestimate of the SCC. DICE clearly underestimates the true value of the SCC by effectively eliminating the possibility of bad draws and fat tails through a deterministic model that relies on the median SCC value. Even with their calculation of the mean SCC, the FUND and PAGE also underestimate the metric's true value by ignoring key features of the climate-economic problem. Properly addressing the limitations of these models' treatment of uncertainty would further increase the SCC.

First, current IAMs insufficiently model catastrophic impacts. DICE fails to model both the possibility of bad draws and fat tails by applying the deterministic approach. Alternatively, FUND and PAGE ignore deep uncertainty by relying predominately on the thin-tailed triangular and gamma distributions.[109] The IWG (2016) only partially addresses this oversight by replacing the ECS parameter in DICE, FUND, and PAGE with a fat-tailed, right-skewed distribution calibrated to the IPCC's assumptions (2007), even though many other economic and climate phenomenon in IAMs are likely characterized by fat tails, including climate damages from high temperature levels, positive climate feedback effects, and tipping

[107] Tol (2008), *supra* note 177, in concluding the FUND model, states, "Uncertainties about climate change impacts are more serious than uncertainties about emission reduction costs, so that welfare-maximizing policies are stricter under uncertainty than under certainty."

[108] IWG (2016).

[109] Howard (2014), *supra* note 184. While both FUND and PAGE employ thin tailed distributions, the resulting distribution of the SCC is not always thin-tailed. In PAGE09, the ECS parameter is endogenous, such that the distribution of the ECS has a long tail following the IPCC (2007). *See* Chen, Z., Mirasgedis, M., Avetisyan, K. D., Tignor, M., & Miller, H. L. (2007). Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. Cambridge, UK and New York: Cambridge University Press, 2010. Similarly, while Anthoff and Tol do not explicitly utilize fat-tail distributions, the distribution of net present welfare from a Monte Carlo simulation is fat-tailed. Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org. Explicitly modeling parameter distributions as fat tailed may further increase the SCC.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

points.[280] Recent work in stochastic dynamic programming tends to better integrate fat tails—particularly with respect to tipping points (see below)—and address additional aversion to this type of uncertainty (also known as ambiguity aversion); doing so can further increase the SCC under uncertainty.[281]

In contrast to their approach to fat tails, the IAMs used by the IWG (2010; 2013; 2016) sometimes address climate tipping points, though they do not apply state-of-the-art methods for doing so. In early versions of DICE (DICE-2010 and earlier), Nordhaus implicitly attributes larger portions of the SCC to tipping points by including certainty equivalent damages of catastrophic events - representing two-thirds to three-quarter of damages in DICE—calibrated to an earlier Nordhaus (1994) survey of experts.[282] In PAGE09, Hope also explicitly models climate tipping points as a singular, discrete event (of a 5% to 25% loss in GDP) that has a probability (which grows as temperature increases) of occurring in each time period.[283] Though not in the preferred versions of the IAMs employed by the IWG, some research also integrates specific tipping points into these IAMs finding even higher SCC estimates.[284] Despite the obvious methodological basis for addressing tipping points, the latest versions of DICE[285] and FUND include tipping points in their preferred specifications. Research shows that if these models were to correctly account for the full range of climate impacts—including tipping points—the resulting SCC estimates would increase.[286]

[280] Weitzman (2011), *supra* note 186; Kopp et al. (2016) *supra* note 183.

[281] Lemoine, D., & Traeger, C. P. (2016a). Ambiguous tipping points. *Journal of Economic Behavior & Organization*, *132*, 5-18; Lemoine & Rudik (2017), *supra* note 178. IAM modelers currently assume that society is equally averse to known unknowns and known unknowns. Lemoine & Traeger, *id.*

[282] Nordhaus, W. D., & Boyer, J. (2000). Warming the World: Economic Models of Global Warming. MIT Press (MA); Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Howard (2014), *supra* note 194; Kopp et al. (2016) *supra* note 183.

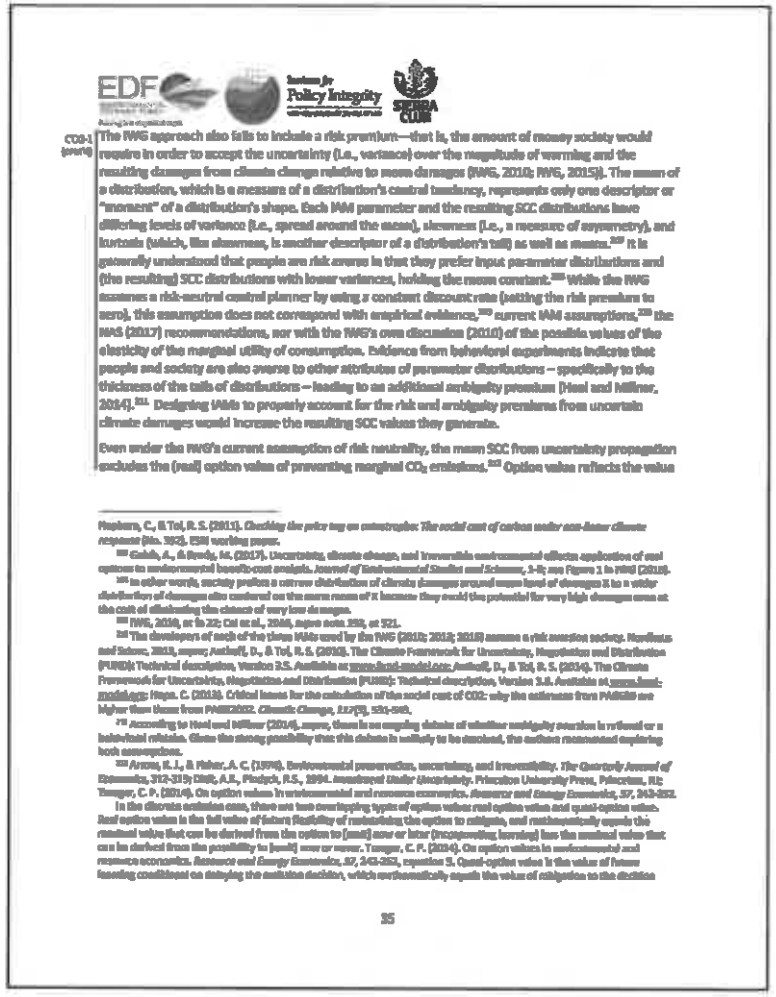
[283] Hope (2006) also calibrated a discontinuous damage function to PAGE-09 used by IWG (2010). Howard (2014), *supra* note 194.

[284] Kopp et al. (2016) *supra* note 183.

[285] For DICE-2013 and DICE-2016, Nordhaus calibrates the DICE damage function using a meta-analysis based on estimates that mostly exclude tipping point damages. Howard, P. H., & Sterner, T. (2016). Few and Not So Far Between: A Meta-analysis of Climate Damage Estimates. *Environmental and Resource Economics*, 1-29.

[286] Using FUND, Link and Tol (2011) find that a collapse of the AMOC would decrease EDP (and thus increase the SCC) by a small amount. Earlier modeling of this collapse in DICE find a more significant increase. Keller, K., Tan, K., Morel, F. M., & Bradford, D. F. (2008). Preserving the ocean circulation: Implications for climate policy. *Climatic Change*, *47*, 17-43; Mastrandrea, M. D., & Schneider, S. H. (2001). Integrated assessment of abrupt climatic changes. *Climate Policy*, *1*(4), 433-449; Keller, K., Bolker, B. M., & Bradford, D. F. (2004). Uncertain climate thresholds and optimal economic growth. *Journal of Environmental Economics and management*, *48*(1), 723-741. With respect to thawing of the permafrost, Hope and Schaefer (2016), Economic impacts of carbon dioxide and methane released from thawing permafrost. *Nature Climate Change*, *6*(1), 56-59, and Gonzalez-Eguino and Neumann (2016), González-Eguino, M., & Neumann, M. B. (2016). Significant implications of permafrost thawing for climate change control. *Climatic Change*, *136*(2), 381-388, find increases in damages (and thus an increase in the SCC) when integrating this tipping element into the PAGE09 and DICE-2013R, respectively. Looking at the collapse of the West Antarctic ice sheet, Nicholls et al. (2006) find a potential for significant increases in costs (and thus the SCC) in FUND. Nicholls, R. J., Tol, R. S., & Vafeidis, A. T. (2008). Global estimates of the impact of a collapse of the West Antarctic ice sheet: an application of FUND. *Climatic Change*, *91*(1), 171-191. Cesarini et al. (2013) model three tipping points (collapse of the Atlantic Ocean Meridional Overturning Circulation, large scale dissociation of oceanic methane hydrates; and a high equilibrium climate sensitivity parameter), and finds a large increase in the SCC in some cases. Cesarini, M., Anthoff, D.,

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd) The IWG approach also fails to include a risk premium—that is, the amount of money society would require in order to accept the uncertainty (i.e., variance) over the magnitude of warming and the resulting damages from climate change relative to mean damages (IWG, 2010; IWG, 2015)). The mean of a distribution, which is a measure of a distribution's central tendency, represents only one descriptor or "moment" of a distribution's shape. Each IAM parameter and the resulting SCC distributions have differing levels of variance (i.e., spread around the mean), skewness (i.e., a measure of asymmetry), and kurtosis (which, like skewness, is another descriptor of a distribution's tail) as well as means.[229] It is generally understood that people are risk averse in that they prefer input parameter distributions and (the resulting) SCC distributions with lower variances, holding the mean constant.[230] While the IWG assumes a risk-neutral central planner by using a constant discount rate (setting the risk premium to zero), this assumption does not correspond with empirical evidence,[231] current IAM assumptions,[232] the NAS (2017) recommendations, nor with the IWG's own discussion (2010) of the possible values of the elasticity of the marginal utility of consumption. Evidence from behavioral experiments indicate that people and society are also averse to other attributes of parameter distributions – specifically to the thickness of the tails of distributions – leading to an additional ambiguity premium (Heal and Millner, 2014).[233] Designing IAMs to properly account for the risk and ambiguity premiums from uncertain climate damages would increase the resulting SCC values they generate.

Even under the IWG's current assumption of risk neutrality, the mean SCC from uncertainty propagation excludes the (real) option value of preventing marginal CO_2 emissions.[234] Option value reflects the value

---

Hepburn, C., & Tol, R. S. (2011). *Checking the price tag on catastrophe: The social cost of carbon under non-linear climate response* (No. 382). ESRI working paper.

[229] Golub, A., & Keely, M. (2017). Uncertainty, climate change, and irreversible environmental effects: application of real options to environmental benefit-cost analysis. *Journal of Environmental Studies and Sciences*, 1-11; see Figure 1 in Pindyck (2012).

[230] In other words, society prefers a narrow distribution of climate damages around some level of damages X to a wider distribution of damages also centered on the same mean of X because they avoid the potential for very high damages even at the cost of eliminating the chance of very low damages.

[231] IWG, 2010, at fn 22; Cai et al., 2048, supra note 203, at 321.

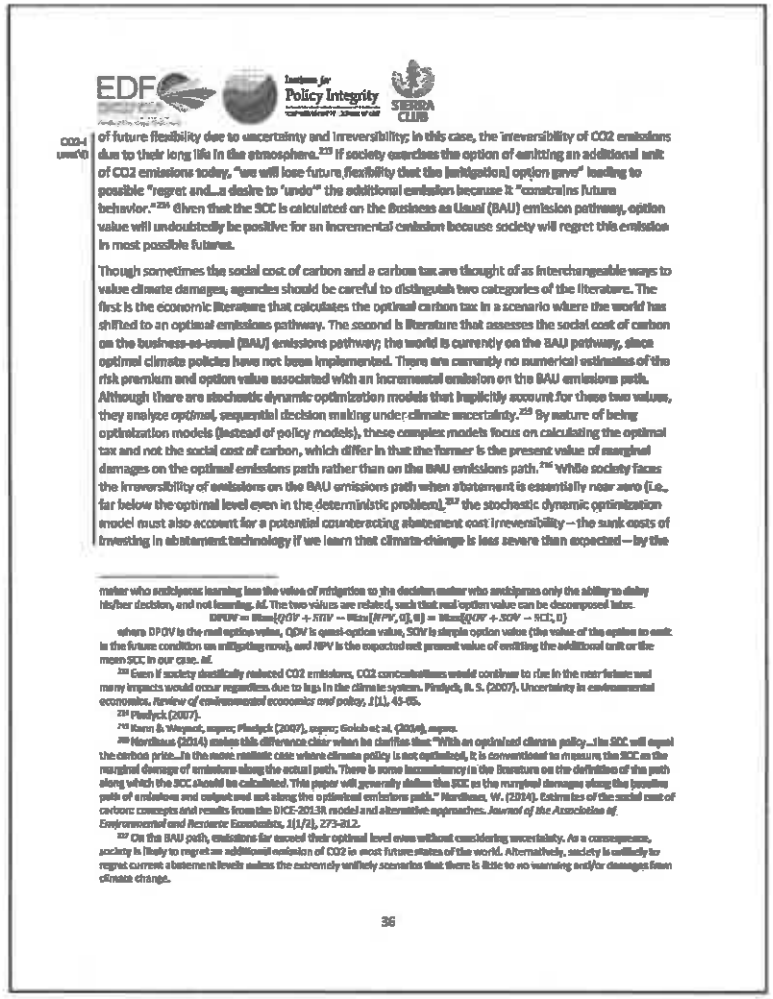
[232] The developers of each of the three IAMs used by the IWG (2010; 2013; 2016) assume a risk neutral society. Nordhaus and Sztorc, 2013, supra; Anthoff, D., & Tol, R. S. (2013). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.5. Available at www.fund-model.org; Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org; Hope, C. (2013). Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002. *Climatic Change*, *117*(3), 531-543.

[233] According to Heal and Millner (2014), supra, there is an ongoing debate of whether ambiguity aversion is rational or a behavioral mistake. Given the strong possibility that this debate is unlikely to be resolved, the authors recommend exploring both assumptions.

[234] Arrow, K. J., & Fisher, A. C. (1974). Environmental preservation, uncertainty, and irreversibility. *The Quarterly Journal of Economics*, 312-319; Dixit, A.K., Pindyck, R.S., 1994. *Investment Under Uncertainty*. Princeton University Press, Princeton, NJ; Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 243-257.

In the climate economics case, there are two overlapping types of option value: real option value and quasi-option value. Real option value is the full value of future flexibility of maintaining the option to mitigate, and mathematically equals the residual value that can be derived from the option to [wait] now or later (incorporating learning) less the residual value that can be derived from the possibility to [wait] now or never. Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 243-253, equation 3. Quasi-option value is the value of future learning conditional on delaying the mitigation decision, which mathematically equals the value of mitigation to the decision

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-I cont'd

of future flexibility due to uncertainty and irreversibility; in this case, the irreversibility of CO2 emissions due to their long life in the atmosphere.[233] If society exercises the option of emitting an additional unit of CO2 emissions today, "we will lose future flexibility that the [mitigation] option gave" leading to possible "regret and...a desire to 'undo'" the additional emission because it "constrains future behavior."[234] Given that the SCC is calculated on the Business as Usual (BAU) emission pathway, option value will undoubtedly be positive for an incremental emission because society will regret this emission in most possible futures.

Though sometimes the social cost of carbon and a carbon tax are thought of as interchangeable ways to value climate damages, agencies should be careful to distinguish two categories of the literature. The first is the economic literature that calculates the optimal carbon tax in a scenario where the world has shifted to an optimal emissions pathway. The second is literature that assesses the social cost of carbon on the business-as-usual (BAU) emissions pathway; the world is currently on the BAU pathway, since optimal climate policies have not been implemented. There are currently no numerical estimates of the risk premium and option value associated with an incremental emission on the BAU emissions path. Although there are stochastic dynamic optimization models that implicitly account for these two values, they analyze *optimal*, sequential decision making under climate uncertainty.[235] By nature of being optimization models (instead of policy models), these complex models focus on calculating the optimal tax and not the social *cost* of carbon, which differ in that the former is the present value of marginal damages on the optimal emissions path rather than on the BAU emissions path.[236] While society faces the irreversibility of emissions on the BAU emissions path when abatement is essentially near zero (i.e., far below the optimal level even in the deterministic problem),[237] the stochastic dynamic optimization model must also account for a potential counteracting abatement cost irreversibility—the sunk costs of investing in abatement technology if we learn that climate change is less severe than expected—by the

meter who anticipates learning has the value of mitigation to the decision maker who anticipates only the ability to delay his/her decision, and not learning. *Id.* The two values are related, such that real option value can be decomposed into:

$$DPOV = \text{Max}[QOV + NPV, 0] - \text{Max}[NPV, 0] = \text{Max}[QOV + SOV - SCI, 0]$$

where DPOV is the real option value, *QOV* is quasi-option value, SOV is simple option value (the value of the option to emit in the future condition on mitigating now), and *NPV* is the expected net present value of emitting the additional unit or the mean SCC in our case. *Id.*

[233] Even if society drastically reduced CO2 emissions, CO2 concentrations would continue to rise in the near future and many impacts would occur regardless due to lags in the climate system. Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65.

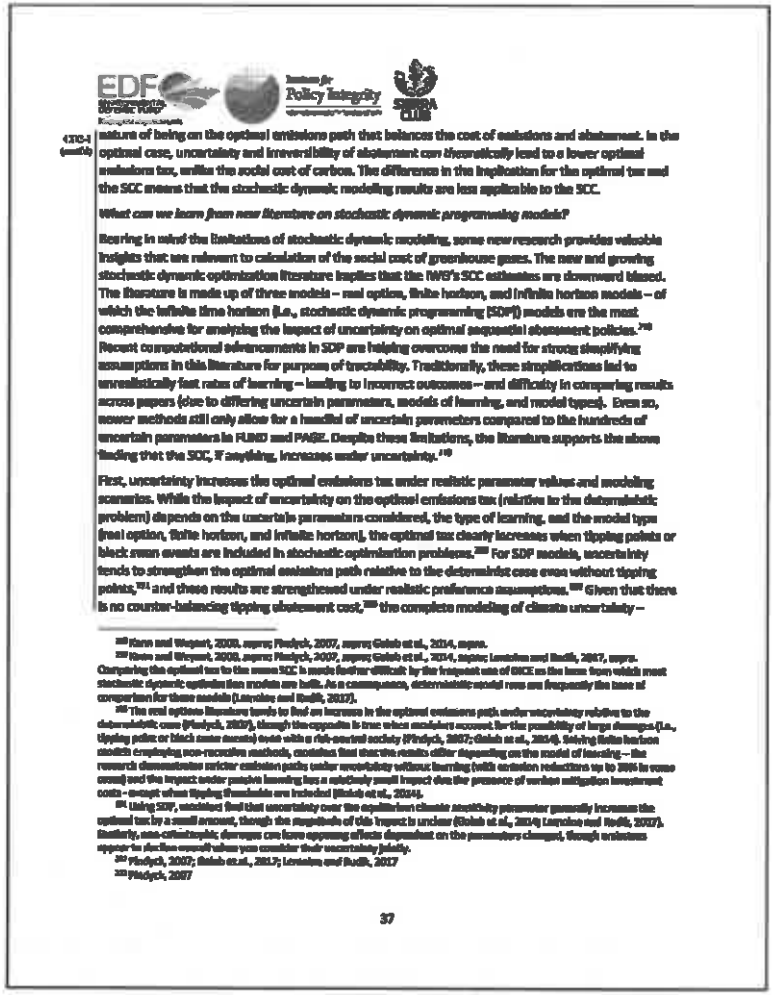
[234] Pindyck (2007).

[235] Kann & Weyant, supra; Pindyck (2007), supra; Golosov et al. (2014), supra.

[236] Nordhaus (2014) makes this difference clear when he clarifies that "With an optimized climate policy...the SCC will equal the carbon price...In the more realistic case where climate policy is not optimized, it is conventional to measure the SCC as the marginal damage of emissions along the actual path. There is some inconsistency in the literature on the definition of the path along which the SCC should be calculated. This paper will generally define the SCC as the marginal damages along the baseline path of emissions and output and not along the optimized emissions path." Nordhaus, W. (2014). Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists*, *1*(1/2), 273-312.

[237] On the BAU path, emissions far exceed their optimal level even without considering uncertainty. As a consequence, society is likely to regret an additional emission of CO2 in most future states of the world. Alternatively, society is unlikely to regret current abatement levels unless the extremely unlikely scenario that there is little to no warming and/or damages from climate change.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

nature of being on the optimal emissions path that balances the cost of emissions and abatement. In the optimal case, uncertainty and irreversibility of abatement *can theoretically* lead to a lower optimal emissions tax, unlike the social cost of carbon. The difference in the implication for the optimal tax and the SCC means that the stochastic dynamic modeling results are less applicable to the SCC.

What can we learn from new literature on stochastic dynamic programming models?

Bearing in mind the limitations of stochastic dynamic modeling, some new research provides valuable insights that are relevant to calculation of the social cost of greenhouse gases. The new and growing stochastic dynamic optimization literature implies that the IWG's SCC estimates are downward biased. The literature is made up of three models – real option, finite horizon, and infinite horizon models – of which the infinite time horizon (i.e., stochastic dynamic programming [SDP]) models are the most comprehensive for analyzing the impact of uncertainty on optimal sequential abatement policies.[100] Recent computational advancements in SDP are helping overcome the need for strong simplifying assumptions in this literature for purpose of tractability. Traditionally, these simplifications led to unrealistically fast rates of learning – leading to incorrect outcomes – and difficulty in comparing results across papers (due to differing uncertain parameters, models of learning, and model types). Even so, newer methods still only allow for a handful of uncertain parameters compared to the hundreds of uncertain parameters in FUND and PAGE. Despite these limitations, the literature supports the above finding that the SCC, if anything, increases under uncertainty.[101]

First, uncertainty increases the optimal emissions tax under realistic parameter values and modeling scenarios. While the impact of uncertainty on the optimal emissions tax (relative to the deterministic problem) depends on the uncertain parameters considered, the type of learning, and the model type (real option, finite horizon, and infinite horizon), the optimal tax clearly increases when tipping points or black swan events are included in stochastic optimization problems.[102] For SDP models, uncertainty tends to strengthen the optimal emissions path relative to the deterministic case even without tipping points,[103] and these results are strengthened under realistic preference assumptions.[104] Given that there is no counter-balancing tipping abatement cost,[105] the complete modeling of climate uncertainty –

[100] Kann and Weyant, 2000, *supra*; Pindyck, 2007, *supra*; Golosov et al., 2014, *supra*.

[101] Kann and Weyant, 2000, *supra*; Pindyck, 2007, *supra*; Golosov et al., 2014, *supra*; Lemoine and Rudik, 2017, *supra*. Comparing the optimal tax to the mean SCC is made further difficult by the frequent use of DICE as the base from which most stochastic dynamic optimization models are built. As a consequence, deterministic model runs are frequently the base of comparison for these models (Lemoine and Rudik, 2017).

[102] The real options literature tends to find an increase in the optimal emissions path under uncertainty relative to the deterministic case (Pindyck, 2000), though the opposite is true when modelers account for the possibility of large damages (i.e., tipping points or black swan events) even with a risk-neutral society (Pindyck, 2007; Golosov et al., 2014). Existing finite horizon models employing non-recursive methods, conclude that the results either depending on the model of learning – the research demonstrates stricter emission paths under uncertainty without learning (with emission reductions up to 20% in some cases) and the impact under passive learning has a relatively small impact due the presence of carbon mitigation investment costs – except when tipping thresholds are included (Golosov et al., 2014).

[103] Using SDP, researchers find that uncertainty over the equilibrium climate sensitivity parameter generally increases the optimal tax by a small amount, though the magnitude of this impact is unclear (Golosov et al., 2014; Lemoine and Rudik, 2017). Similarly, non-catastrophic damages can have opposing effects dependent on the parameters changed, though emissions appear to decline overall when you consider their uncertainty jointly.

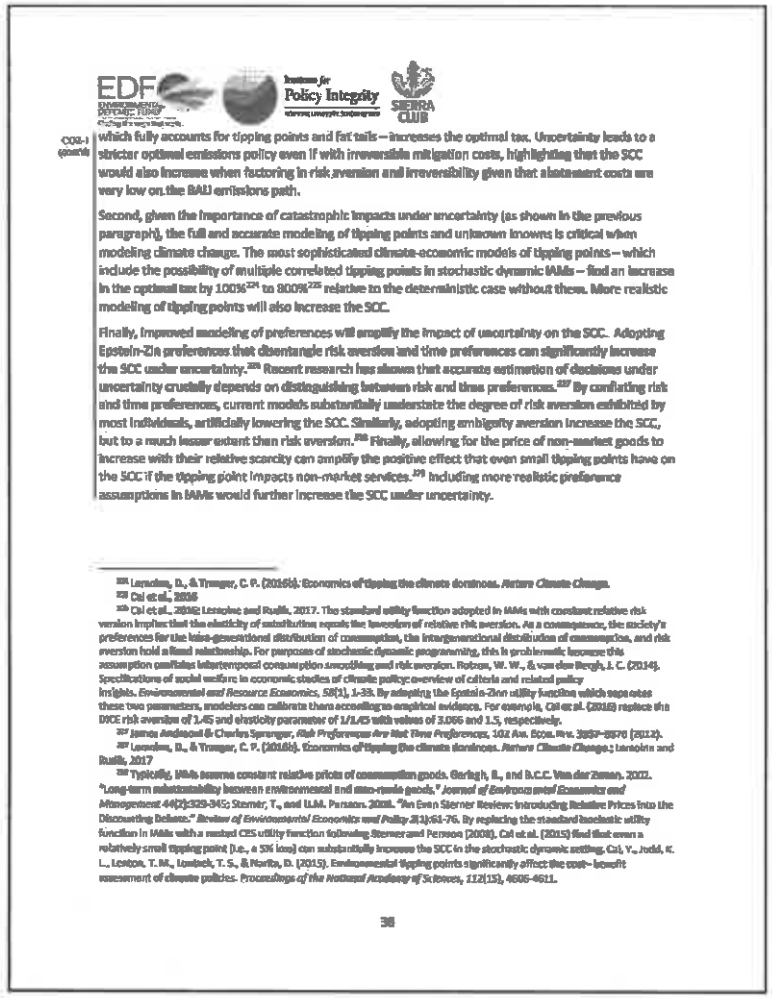
[104] Pindyck, 2007; Golosov et al., 2017; Lemoine and Rudik, 2017

[105] Pindyck, 2007

37

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)



which fully accounts for tipping points and fat tails—increases the optimal tax. Uncertainty leads to a stricter optimal emissions policy even if with irreversible mitigation costs, highlighting that the SCC would also increase when factoring in risk aversion and irreversibility given that abatement costs are very low on the BAU emissions path.

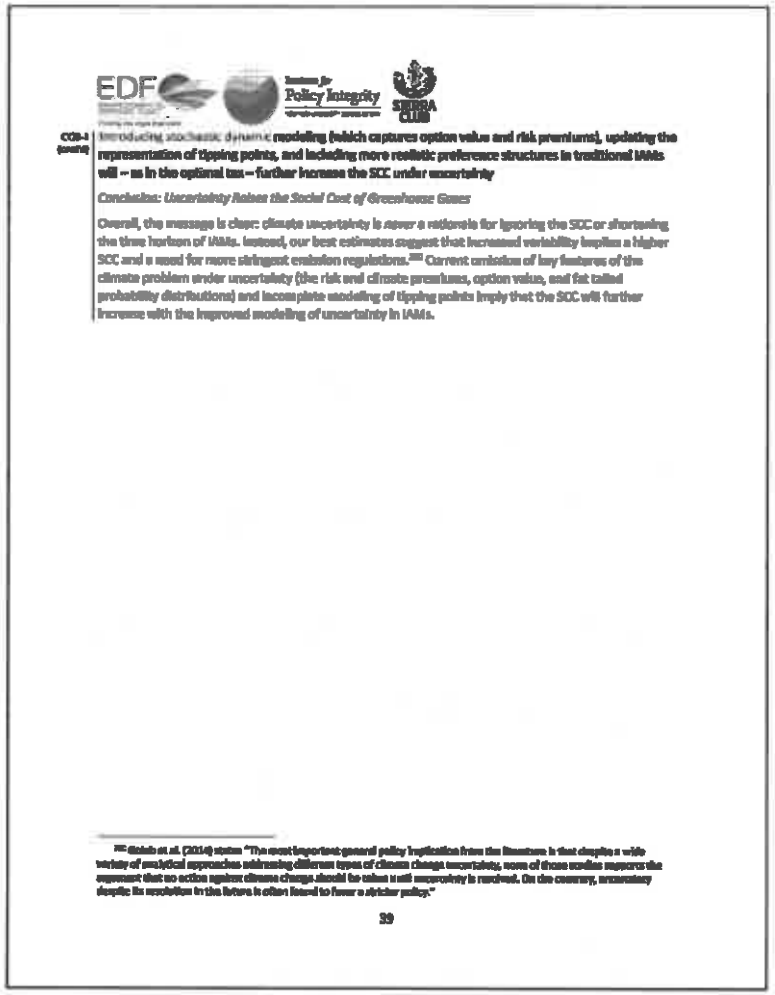
Second, given the importance of catastrophic impacts under uncertainty (as shown in the previous paragraph), the full and accurate modeling of tipping points and unknown knowns is critical when modeling climate change. The most sophisticated climate-economic models of tipping points—which include the possibility of multiple correlated tipping points in stochastic dynamic IAMs—find an increase in the optimal tax by 100%[224] to 800%[225] relative to the deterministic case without them. More realistic modeling of tipping points will also increase the SCC.

Finally, improved modeling of preferences will amplify the impact of uncertainty on the SCC. Adopting Epstein-Zin preferences that disentangle risk aversion and time preferences can significantly increase the SCC under uncertainty.[226] Recent research has shown that accurate estimation of decisions under uncertainty crucially depends on distinguishing between risk and time preferences.[227] By conflating risk and time preferences, current models substantially understate the degree of risk aversion exhibited by most individuals, artificially lowering the SCC. Similarly, adopting ambiguity aversion increase the SCC, but to a much lesser extent than risk aversion.[228] Finally, allowing for the price of non-market goods to increase with their relative scarcity can amplify the positive effect that even small tipping points have on the SCC if the tipping point impacts non-market services.[229] Including more realistic preference assumptions in IAMs would further increase the SCC under uncertainty.

[224] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominos. *Nature Climate Change*.
[225] Cai et al., 2016
[226] Cai et al., 2016; Lemoine and Rudik, 2017. The standard utility function adopted in IAMs with constant relative risk version implies that the elasticity of substitution equals the inverse of relative risk aversion. As a consequence, the society's preferences for the inter-generational distribution of consumption, the intergenerational distribution of consumption, and risk aversion hold a fixed relationship. For purposes of stochastic dynamic programming, this is problematic because this assumption conflates intertemporal consumption smoothing and risk aversion. Pottier, W. W., & van der Bergh, J. C. (2014). Specifications of social welfare in economic studies of climate policy: overview of criteria and related policy insights. *Environmental and Resource Economics*, 58(1), 1-33. By adopting the Epstein-Zinn utility function which separates these two parameters, modelers can calibrate them according to empirical evidence. For example, Cai et al. (2016) replace the DICE risk aversion of 1.45 and elasticity parameter of 1/1.45 with values of 3.066 and 1.5, respectively.
[227] James Andreoni & Charles Sprenger, *Risk Preferences Are Not Time Preferences*, 102 Am. Econ. Rev. 3357-3376 (2012).
[228] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominos. *Nature Climate Change*; Lemoine and Rudik, 2017
[229] Typically, IAMs assume constant relative prices of consumption goods. Gerlagh, R., and B.C.C. Van der Zwaan. 2002. "Long-term substitutability between environmental and man-made goods." *Journal of Environmental Economics and Management* 44(2):329-345; Sterner, T., and U.M. Persson. 2008. "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate." *Review of Environmental Economics and Policy* 2(1):61-76. By replacing the standard isoelastic utility function in IAMs with a nested CES utility function following Sterner and Persson (2008), Cai et al. (2015) find that even a relatively small tipping point (i.e., a 5% loss) can substantially increase the SCC in the stochastic dynamic setting. Cai, Y., Judd, K. L., Lenton, T. M., Lontzek, T. S., & Narita, D. (2015). Environmental tipping points significantly affect the cost-benefit assessment of climate policies. Proceedings *of the National Academy of Sciences*, *112*(15), 4606-4611.

38

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

introducing stochastic dynamic modeling (which captures option value and risk premiums), updating the representation of tipping points, and including more realistic preference structures in traditional IAMs will – as in the optimal tax – further increase the SCC under uncertainty

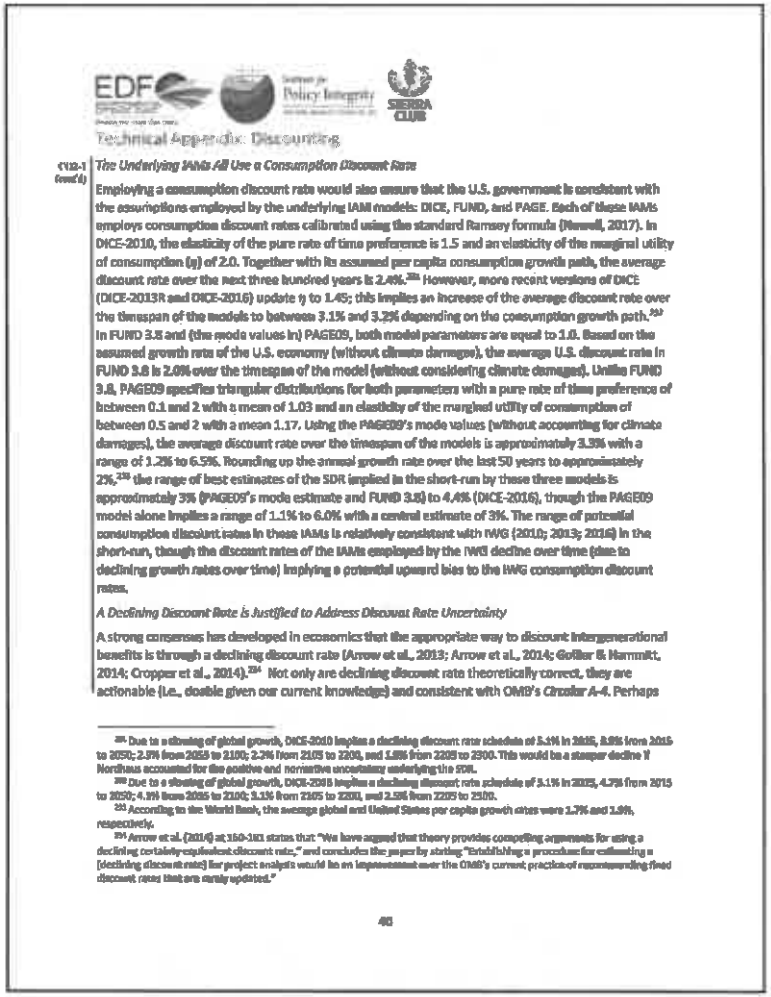
Conclusion: Uncertainty Raises the Social Cost of Greenhouse Gases

Overall, the message is clear: climate uncertainty is *never* a rationale for ignoring the SCC or shortening the time horizon of IAMs. Instead, our best estimates suggest that increased variability implies a higher SCC and a need for more stringent emission regulations.[20] Current omission of key features of the climate problem under uncertainty (the risk and climate premiums, option value, and fat tailed probability distributions) and incomplete modeling of tipping points imply that the SCC will further increase with the improved modeling of uncertainty in IAMs.

[20] Gollier et al. (2014) states "The most important general policy implication from the literature is that despite a wide variety of analytical approaches addressing different types of climate change uncertainty, none of these studies supports the argument that no action against climate change should be taken until uncertainty is resolved. On the contrary, precautionary depths: its resolution in the future is often found to favor a stricter policy."

39

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



EDF Institute for Policy Integrity SIERRA CLUB

Technical Appendix: Discounting

CO2-1 (cont'd)

The Underlying IAMs All Use a Consumption Discount Rate

Employing a consumption discount rate would also ensure that the U.S. government is consistent with the assumptions employed by the underlying IAM models: DICE, FUND, and PAGE. Each of these IAMs employs consumption discount rates calibrated using the standard Ramsey formula (Newell, 2017). In DICE-2010, the elasticity of the pure rate of time preference is 1.5 and an elasticity of the marginal utility of consumption (η) of 2.0. Together with its assumed per capita consumption growth path, the average discount rate over the next three hundred years is 2.4%.[231] However, more recent versions of DICE (DICE-2013R and DICE-2016) update η to 1.45; this implies an increase of the average discount rate over the timespan of the models to between 3.1% and 3.2% depending on the consumption growth path.[232] In FUND 3.8 and (the mode values in) PAGE09, both model parameters are equal to 1.0. Based on the assumed growth rate of the U.S. economy (without climate damages), the average U.S. discount rate in FUND 3.8 is 2.0% over the timespan of the model (without considering climate damages). Unlike FUND 3.8, PAGE09 specifies triangular distributions for both parameters with a pure rate of time preference of between 0.1 and 2 with a mean of 1.03 and an elasticity of the marginal utility of consumption of between 0.5 and 2 with a mean 1.17. Using the PAGE09's mode values (without accounting for climate damages), the average discount rate over the timespan of the models is approximately 3.3% with a range of 1.2% to 6.5%. Rounding up the annual growth rate over the last 50 years to approximately 2%,[233] the range of best estimates of the SDR implied in the short-run by these three models is approximately 3% (PAGE09's mode estimate and FUND 3.8) to 4.4% (DICE-2016), though the PAGE09 model alone implies a range of 1.1% to 6.0% with a central estimate of 3%. The range of potential consumption discount rates in these IAMs is relatively consistent with IWG (2010; 2013; 2016) in the short-run, though the discount rates of the IAMs employed by the IWG decline over time (due to declining growth rates over time) implying a potential upward bias to the IWG consumption discount rates.

A Declining Discount Rate is Justified to Address Discount Rate Uncertainty

A strong consensus has developed in economics that the appropriate way to discount intergenerational benefits is through a declining discount rate (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[234] Not only are declining discount rate theoretically correct, they are actionable (i.e., doable given our current knowledge) and consistent with OMB's *Circular A-4*. Perhaps

[231] Due to a slowing of global growth, DICE-2010 implies a declining discount rate schedule of 5.1% in 2015, 3.5% from 2015 to 2050; 2.5% from 2050 to 2100; 2.2% from 2105 to 2200, and 1.5% from 2205 to 2300. This would be a steeper decline if Nordhaus accounted for the positive and normative uncertainty underlying the SDR.

[232] Due to a slowing of global growth, DICE-2016 implies a declining discount rate schedule of 5.1% in 2015, 4.7% from 2015 to 2050; 4.1% from 2050 to 2100; 3.1% from 2105 to 2200, and 2.5% from 2205 to 2300.

[233] According to the World Bank, the average global and United States per capita growth rates were 1.7% and 1.9%, respectively.

[234] Arrow et al. (2014) at 150-151 states that "We have argued that theory provides compelling arguments for using a declining certainty-equivalent discount rate," and concludes the paper by stating "Establishing a procedure for estimating a [declining discount rate] for project analysis would be an improvement over the OMB's current practice of recommending fixed discount rates that are rarely updated."

40

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1

the best reason to adopt a declining discount rate is the simple fact that there is considerable uncertainty around which discount rate to use. The uncertainty in the rate points directly to the need to use a declining rate, as the impact of the uncertainty grows exponentially over time such that the correct discount rate is not an arithmetic average of possible discount rates.[205] Uncertainty about future discount rates could stem from a number of sources particularly salient in the context of climate change, including uncertainty about future economic growth, consumption, the consumption rate of interest, and preferences. Additionally, economic theory shows that if there is debate or disagreement over which discount rate to use, this should lead to the use of a declining discount rate (Weitzman, 2001; Heal & Millner, 2014). Though, the range of potential discount rates is limited by theory to potential consumption discount rates (see earlier discussion), which is certainly less than 7%.

There is a consensus that declining discount rates are appropriate for intergenerational discounting

Since the IWG undertook its initial analysis and before the most recent estimates of the SCC, a large and growing majority of leading climate economists consensus (Arrow et al., 2013) has come out in favor of using a declining discount rate for climate changes to reflect long-term uncertainty in interest rates. This consensus view is held whether economists favor descriptive (i.e., market) or prescriptive (i.e., normative) approaches to discounting (Freeman et al., 2015). Several key papers (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014) outline this consensus and present the arguments that strongly support the use of declining discount rates for long-term benefit-cost analysis in both the normative and positive contexts. Finally, in a recent survey of experts on the economics of climate change, Howard and Sylvan (2015), found that experts support using a declining discount rate relative to a constant discount rate at a ratio of approximately 2 to 1.

Economists have recently highlighted two main motivations for using a declining discount rate, which we elaborate on in what follows. First, if the discount rate for a project is fixed but uncertain, then the certainty-equivalent discount rate will decline over time, meaning that benefits should be discounted using a declining rate.[206] Second, uncertainty about the growth rate of consumption or output also implies that a declining discount rate should be used, so long as shocks to consumption are positively correlated over time.[207] In addition to these two arguments, other motivations for declining discount rates have long been recognized. For instance, if the growth rate of consumption declines over time, the Ramsey rule[208] for discounting will lead to a declining discount rate.[209]

---

[205] Barp (2008) states that mathematical "intuition for this result is that as [time] increases, smaller values of r in the support of the distribution are relatively more important in determining the magnitude of e^{-rt} where r is the constant discount rate." Or as Hepburn et al. (2008) puts it, "The intuition behind this idea is that scenarios with a higher discount rate are given less weight as time passes, precisely because their discount factor is falling more rapidly" over time.

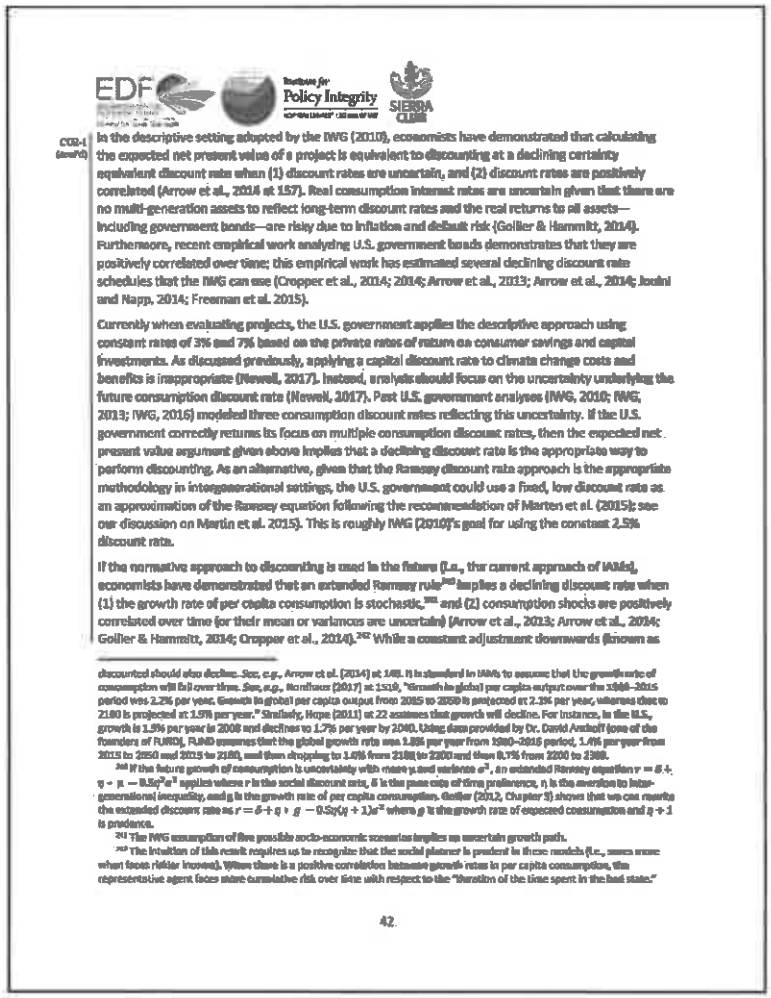
[206] This argument was first developed in Weitzman (1998) and Weitzman (2001).

[207] See, e.g., Gollier (2009).

[208] The Ramsey discount rate equation for the social discount rate is $r = \delta + \eta \times g$ where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and g is the growth rate of per capita consumption. For the original development, see, Ramsey, F.P. (1928). A Mathematical Theory of Saving. *The Economic Journal*, 38(152).

[209] Higher growth rates lead to higher discounting of the future in the Ramsey model because growth will make future generations wealthier. If marginal utility of consumption declines in consumption, then, one should more heavily discount consumption gains by wealthier generations. Thus, if growth rates decline over time, then the rate at which the future is

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



EDF Institute for Policy Integrity SIERRA CLUB

CO2-1 (cont'd)

In the descriptive setting adopted by the IWG (2010), economists have demonstrated that calculating the expected net present value of a project is equivalent to discounting at a declining certainty equivalent discount rate when (1) discount rates are uncertain, and (2) discount rates are positively correlated (Arrow et al., 2014 at 157). Real consumption interest rates are uncertain given that there are no multi-generation assets to reflect long-term discount rates and the real returns to all assets—including government bonds—are risky due to inflation and default risk (Gollier & Hammitt, 2014). Furthermore, recent empirical work analyzing U.S. government bonds demonstrates that they are positively correlated over time; this empirical work has estimated several declining discount rate schedules that the IWG can use (Cropper et al., 2014; 2014; Arrow et al., 2013; Arrow et al., 2014; Jouini and Napp, 2014; Freeman et al. 2015).

Currently when evaluating projects, the U.S. government applies the descriptive approach using constant rates of 3% and 7% based on the private rates of return on consumer savings and capital investments. As discussed previously, applying a capital discount rate to climate change costs and benefits is inappropriate (Newell, 2017). Instead, analysis should focus on the uncertainty underlying the future consumption discount rate (Newell, 2017). Past U.S. government analyses (IWG, 2010; IWG, 2013; IWG, 2016) modeled three consumption discount rates reflecting this uncertainty. If the U.S. government correctly returns its focus on multiple consumption discount rates, then the expected net present value argument given above implies that a declining discount rate is the appropriate way to perform discounting. As an alternative, given that the Ramsey discount rate approach is the appropriate methodology in intergenerational settings, the U.S. government could use a fixed, low discount rate as an approximation of the Ramsey equation following the recommendation of Marten et al. (2015); see our discussion on Martin et al. 2015). This is roughly IWG (2010)'s goal for using the constant 2.5% discount rate.

If the normative approach to discounting is used in the future (i.e., the current approach of IAMs), economists have demonstrated that an extended Ramsey rule[260] implies a declining discount rate when (1) the growth rate of per capita consumption is stochastic,[261] and (2) consumption shocks are positively correlated over time (or their mean or variances are uncertain) (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[262] While a constant adjustment downwards (known as

discounted should also decline. See, e.g., Arrow et al. (2014) at 148. It is standard in IAMs to assume that the growth rate of consumption will fall over time. See, e.g., Nordhaus (2017) at 1519, "Growth in global per capita output over the 1948–2015 period was 2.2% per year. Growth in global per capita output from 2015 to 2050 is projected at 2.1% per year, whereas that to 2100 is projected at 1.9% per year." Similarly, Hope (2011) at 22 assumes that growth will decline. For instance, in the U.S., growth is 1.9% per year in 2008 and declines to 1.7% per year by 2040. Using data provided by Dr. David Anthoff (one of the founders of FUND), FUND assumes that the global growth rate was 1.8% per year from 1980–2015 period, 1.4% per year from 2015 to 2050 and 2015 to 2100, and then dropping to 1.4% from 2100 to 2200 and then 0.7% from 2200 to 2300.

[260] If the future growth of consumption is uncertainly with mean μ and variance σ^2, an extended Ramsey equation $r = \delta + \eta \cdot g - \mu - 0.5\eta^2\sigma^2$ applies where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and g is the growth rate of per capita consumption. Gollier (2012, Chapter 9) shows that we can rewrite the extended discount rate as $r = \delta + g - 0.5\eta(\eta + 1)\sigma^2$ where g is the growth rate of expected consumption and $\eta + 1$ is prudence.

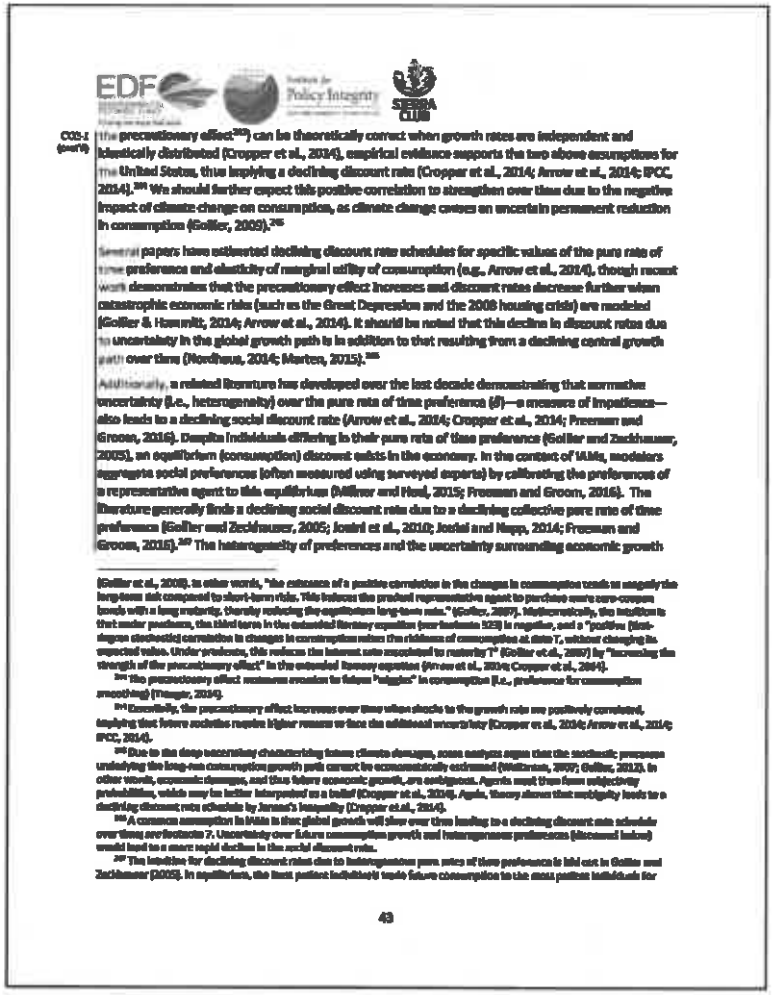
[261] The IWG assumption of five possible socio-economic scenarios implies an uncertain growth path.

[262] The intuition of this result requires us to recognize that the social planner is prudent in these models (i.e., saves more when faces riskier income). When there is a positive correlation between growth rates in per capita consumption, the representative agent faces more cumulative risk over time with respect to the "duration of the time spent in the bad state."

42

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)



the precautionary effect[203]) can be theoretically correct when growth rates are independent and identically distributed (Cropper et al., 2014), empirical evidence supports the two above assumptions for the United States, thus implying a declining discount rate (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014).[204] We should further expect this positive correlation to strengthen over time due to the negative impact of climate change on consumption, as climate change carries an uncertain permanent reduction in consumption (Gollier, 2009).[205]

Several papers have estimated declining discount rate schedules for specific values of the pure rate of time preference and elasticity of marginal utility of consumption (e.g., Arrow et al., 2014), though recent work demonstrates that the precautionary effect increases and discount rates decrease further when catastrophic economic risks (such as the Great Depression and the 2008 housing crisis) are modeled (Gollier & Hammitt, 2014; Arrow et al., 2014). It should be noted that this decline in discount rates due to uncertainty in the global growth path is in addition to that resulting from a declining central growth path over time (Nordhaus, 2014; Marten, 2015).[206]

Additionally, a related literature has developed over the last decade demonstrating that normative uncertainty (i.e., heterogeneity) over the pure rate of time preference (δ)—a measure of impatience—also leads to a declining social discount rate (Arrow et al., 2014; Cropper et al., 2014; Freeman and Groom, 2016). Despite individuals differing in their pure rate of time preference (Gollier and Zeckhauser, 2005), an equilibrium (consumption) discount exists in the economy. In the context of IAMs, modelers aggregate social preferences (often measured using surveyed experts) by calibrating the preferences of a representative agent to this equilibrium (Millner and Heal, 2015; Freeman and Groom, 2016). The literature generally finds a declining social discount rate due to a declining collective pure rate of time preference (Gollier and Zeckhauser, 2005; Jouini et al., 2010; Jouini and Napp, 2014; Freeman and Groom, 2016).[207] The heterogeneity of preferences and the uncertainty surrounding economic growth

(Gollier et al., 2008). In other words, "the existence of a positive correlation in the changes in consumption tends to magnify the long-term risk compared to short-term risk. This induces the prudent representative agent to purchase more zero-coupon bonds with a long maturity, thereby reducing the equilibrium long-term rate." (Gollier, 2007). Mathematically, the intuition is that under prudence, the third term in the extended Ramsey equation (see footnote 123) is negative, and a "positive (first-degree stochastic) correlation in changes in consumption raises the riskiness of consumption at date T, without changing its expected value. Under prudence, this reduces the interest rate associated to maturity T" (Gollier et al., 2007) by "increasing the strength of the precautionary effect" in the extended Ramsey equation (Arrow et al., 2014; Cropper et al., 2014).

[203] The precautionary effect measures aversion to future "wiggles" in consumption (i.e., preference for consumption smoothing) (Traeger, 2014).

[204] Essentially, the precautionary effect increases over time when shocks to the growth rate are positively correlated, implying that future societies require higher returns to face the additional uncertainty (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014).

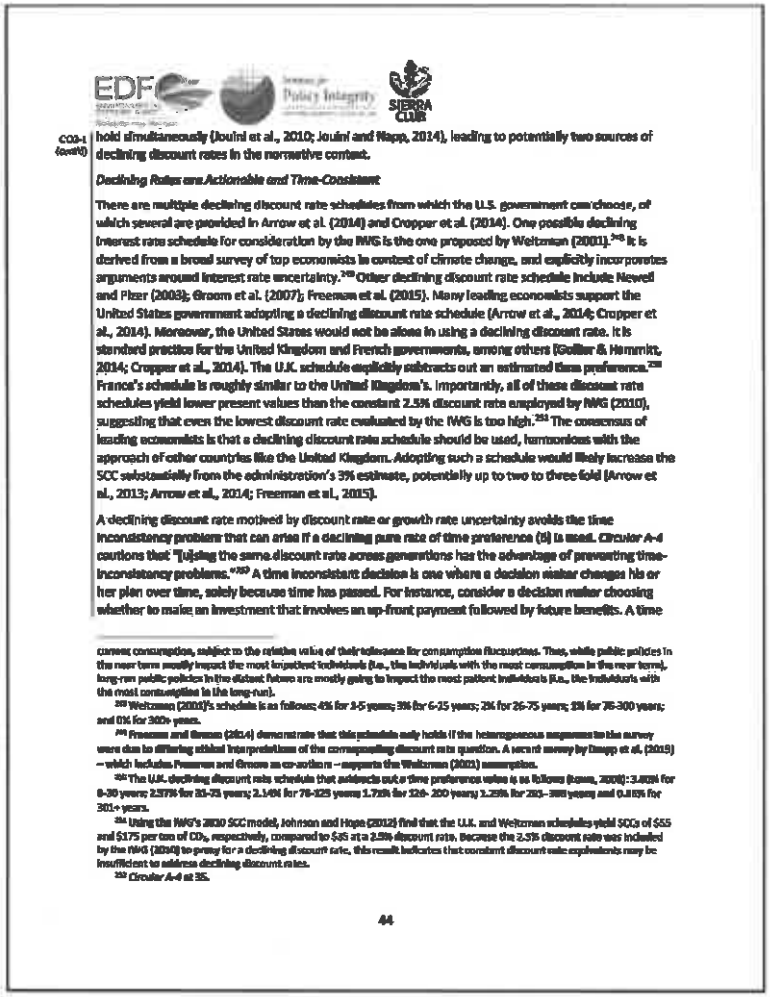
[205] Due to the deep uncertainty characterizing future climate damages, some analysts argue that the stochastic processes underlying the long-run consumption growth path cannot be econometrically estimated (Weitzman, 2007; Gollier, 2012). In other words, economic damages, and thus future economic growth, are ambiguous. Agents must then form subjective probabilities, which may be better interpreted as a belief (Cropper et al., 2014). Again, theory shows that ambiguity leads to a declining discount rate schedule by Jensen's inequality (Cropper et al., 2014).

[206] A common assumption in IAMs is that global growth will slow over time leading to a declining discount rate schedule over time; see footnote 7. Uncertainty over future consumption growth and heterogeneous preferences (discussed below) would lead to a more rapid decline in the social discount rate.

[207] The intuition for declining discount rates due to heterogeneous pure rates of time preference is laid out in Gollier and Zeckhauser (2005). In equilibrium, the least patient individual trades future consumption to the most patient individuals for

43

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

hold simultaneously (Joutni et al., 2010; Joutni and Napp, 2014), leading to potentially two sources of declining discount rates in the normative context.

Declining Rates are Actionable and Time-Consistent

There are multiple declining discount rate schedules from which the U.S. government can choose, of which several are provided in Arrow et al. (2014) and Cropper et al. (2014). One possible declining interest rate schedule for consideration by the IWG is the one proposed by Weitzman (2001).[248] It is derived from a broad survey of top economists in context of climate change, and explicitly incorporates arguments around interest rate uncertainty.[249] Other declining discount rate schedule include Newell and Pizer (2003); Groom et al. (2007); Freeman et al. (2015). Many leading economists support the United States government adopting a declining discount rate schedule (Arrow et al., 2014; Cropper et al., 2014). Moreover, the United States would not be alone in using a declining discount rate. It is standard practice for the United Kingdom and French governments, among others (Gollier & Hammitt, 2014; Cropper et al., 2014). The U.K. schedule explicitly subtracts out an estimated time preference.[250] France's schedule is roughly similar to the United Kingdom's. Importantly, all of these discount rate schedules yield lower present values than the constant 2.5% discount rate employed by IWG (2010), suggesting that even the lowest discount rate evaluated by the IWG is too high.[251] The consensus of leading economists is that a declining discount rate schedule should be used, harmonious with the approach of other countries like the United Kingdom. Adopting such a schedule would likely increase the SCC substantially from the administration's 3% estimate, potentially up to two to three fold (Arrow et al., 2013; Arrow et al., 2014; Freeman et al., 2015).

A declining discount rate motived by discount rate or growth rate uncertainty avoids the time inconsistency problem that can arise if a declining pure rate of time preference (δ) is used. *Circular A-4* cautions that "[u]sing the same discount rate across generations has the advantage of preventing time-inconsistency problems."[252] A time inconsistent decision is one where a decision maker changes his or her plan over time, solely because time has passed. For instance, consider a decision maker choosing whether to make an investment that involves an up-front payment followed by future benefits. A time

current consumption, subject to the relative value of their tolerance for consumption fluctuations. Thus, while public policies in the near term usually impact the most impatient individuals (i.e., the individuals with the most consumption in the near term), long-run public policies in the distant future are mostly going to impact the most patient individuals (i.e., the individuals with the most consumption in the long-run).

[248] Weitzman (2001)'s schedule is as follows: 4% for 1-5 years; 3% for 6-25 years; 2% for 26-75 years; 1% for 76-300 years; and 0% for 300+ years.

[249] Freeman and Groom (2014) demonstrate that this schedule only holds if the heterogeneous responses to the survey were due to differing ethical interpretations of the corresponding discount rate question. A recent survey by Drupp et al. (2015) – which includes Freeman and Groom as co-authors – supports the Weitzman (2001) assumption.

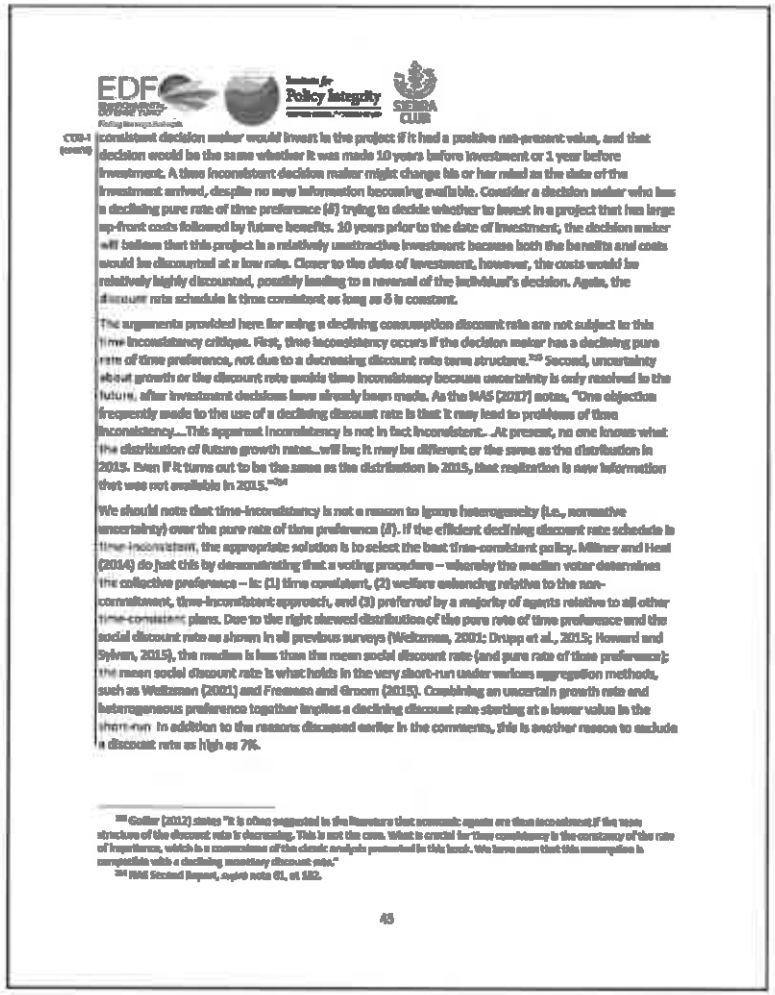
[250] The U.K. declining discount rate schedule that subtracts out a time preference rate is as follows (Green, 2008): 3.50% for 0-30 years; 2.57% for 31-75 years; 2.14% for 76-125 years; 1.72% for 126- 200 years; 1.29% for 201- 300 years; and 0.86% for 301+ years.

[251] Using the IWG's 2010 SCC model, Johnson and Hope (2012) find that the U.K. and Weitzman schedules yield SCCs of $55 and $175 per ton of CO_2, respectively, compared to $35 at a 2.5% discount rate. Because the 2.5% discount rate was included by the IWG (2010) to proxy for a declining discount rate, this result indicates that constant discount rate equivalents may be insufficient to address declining discount rates.

[252] *Circular A-4* at 35.

44

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

consistent decision maker would invest in the project if it had a positive net-present value, and that decision would be the same whether it was made 10 years before investment or 1 year before investment. A time inconsistent decision maker might change his or her mind as the date of the investment arrived, despite no new information becoming available. Consider a decision maker who has a declining pure rate of time preference (δ) trying to decide whether to invest in a project that has large up-front costs followed by future benefits. 10 years prior to the date of investment, the decision maker will believe that this project is a relatively unattractive investment because both the benefits and costs would be discounted at a low rate. Closer to the date of investment, however, the costs would be relatively highly discounted, possibly leading to a reversal of the individual's decision. Again, the discount rate schedule is time consistent so long as δ is constant.

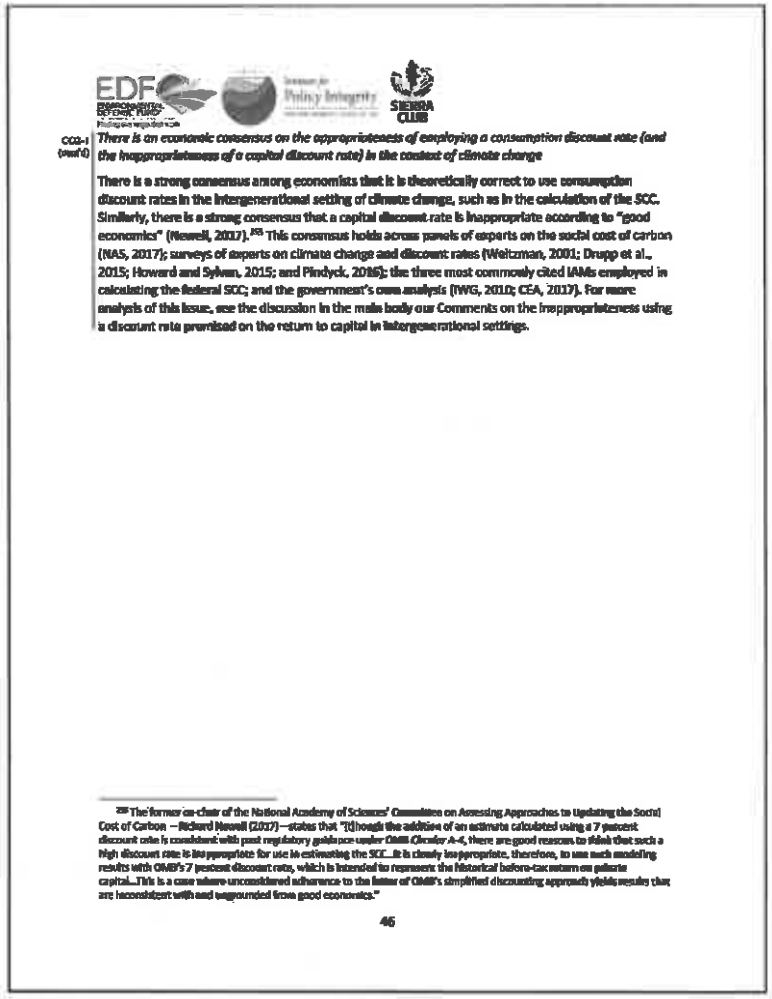
The arguments provided here for using a declining consumption discount rate are not subject to this time inconsistency critique. First, time inconsistency occurs if the decision maker has a declining pure rate of time preference, not due to a decreasing discount rate term structure.[33] Second, uncertainty about growth or the discount rate avoids time inconsistency because uncertainty is only resolved in the future, after investment decisions have already been made. As the NAS (2017) notes, "One objection frequently made to the use of a declining discount rate is that it may lead to problems of time inconsistency…This apparent inconsistency is not in fact inconsistent. …At present, no one knows what the distribution of future growth rates…will be; it may be different or the same as the distribution in 2015. Even if it turns out to be the same as the distribution in 2015, that realization is new information that was not available in 2015."[34]

We should note that time-inconsistency is not a reason to ignore heterogeneity (i.e., normative uncertainty) over the pure rate of time preference (δ). If the efficient declining discount rate schedule is time-inconsistent, the appropriate solution is to select the best time-consistent policy. Millner and Heal (2014) do just this by demonstrating that a voting procedure – whereby the median voter determines the collective preference – is: (1) time consistent, (2) welfare enhancing relative to the non-commitment, time-inconsistent approach, and (3) preferred by a majority of agents relative to all other time-consistent plans. Due to the right skewed distribution of the pure rate of time preference and the social discount rate as shown in all previous surveys (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015), the median is less than the mean social discount rate (and pure rate of time preference); the mean social discount rate is what holds in the very short-run under various aggregation methods, such as Weitzman (2001) and Freeman and Groom (2015). Combining an uncertain growth rate and heterogeneous preference together implies a declining discount rate starting at a lower value in the short-run. In addition to the reasons discussed earlier in the comments, this is another reason to exclude a discount rate as high as 7%.

[33] Gollier (2012) states "It is often suggested in the literature that economic agents are time inconsistent if the term structure of the discount rate is decreasing. This is not the case. What is crucial for time consistency is the constancy of the rate of impatience, which is a consequence of the classic analysis presented in this book. We have seen that this assumption is compatible with a declining monetary discount rate."

[34] NAS Second Report, *supra* note 61, at 182.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)



CO2-1 (cont'd)

There is an economic consensus on the appropriateness of employing a consumption discount rate (and the inappropriateness of a capital discount rate) in the context of climate change

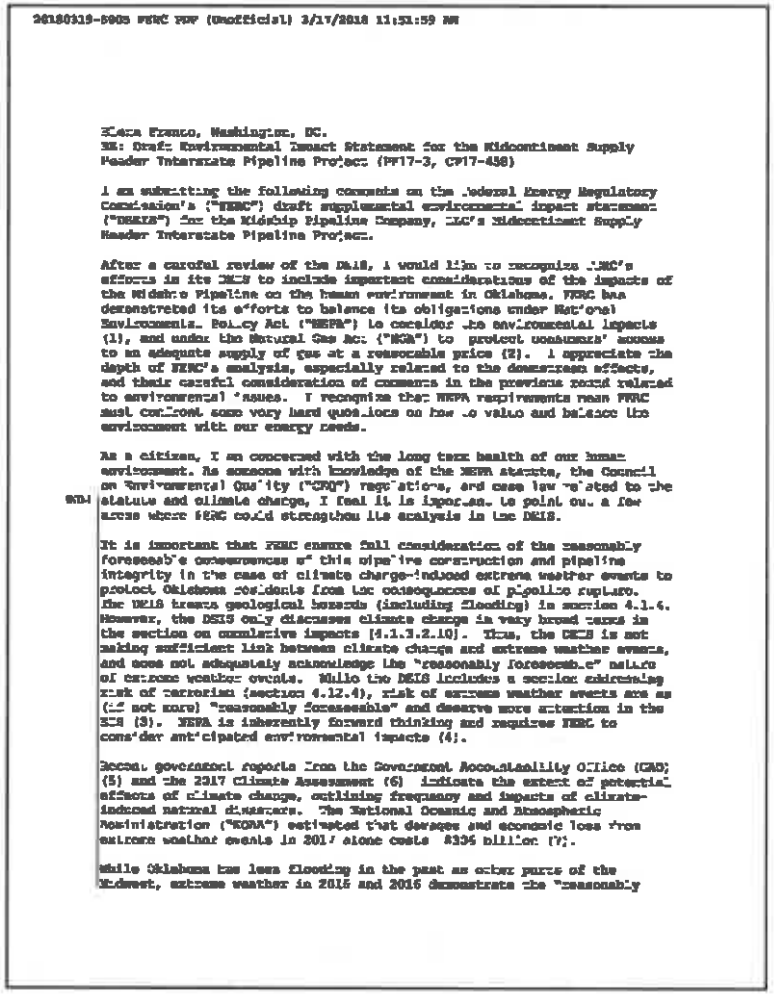
There is a strong consensus among economists that it is theoretically correct to use consumption discount rates in the intergenerational setting of climate change, such as in the calculation of the SCC. Similarly, there is a strong consensus that a capital discount rate is inappropriate according to "good economics" (Newell, 2017).[25] This consensus holds across panels of experts on the social cost of carbon (NAS, 2017); surveys of experts on climate change and discount rates (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015; and Pindyck, 2019); the three most commonly cited IAMs employed in calculating the federal SCC; and the government's own analysis (IWG, 2010; CEA, 2017). For more analysis of this issue, see the discussion in the main body our Comments on the inappropriateness using a discount rate premised on the return to capital in intergenerational settings.

[25] The former co-chair of the National Academy of Sciences' Committee on Assessing Approaches to Updating the Social Cost of Carbon – Richard Newell (2017) – states that "[t]hough the addition of an estimate calculated using a 7 percent discount rate is consistent with past regulatory guidance under OMB *Circular A-4*, there are good reasons to think that such a high discount rate is inappropriate for use in estimating the SCC…It is clearly inappropriate, therefore, to use such modeling results with OMB's 7 percent discount rate, which is intended to represent the historical before-tax return on private capital…This is a case where unconsidered adherence to the letter of OMB's simplified discounting approach yields results that are inconsistent with and unsupported from good economics."

46

INDIVIDUALS (IND)

IND1 – Elena Franco



20180319-5005 FERC PDF (Unofficial) 3/17/2018 11:51:59 AM

Elena Franco, Washington, DC.
RE: Draft Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project (PF17-3, CP17-458)

I am submitting the following comments on the Federal Energy Regulatory Commission's ("FERC") draft supplemental environmental impact statement ("DSEIS") for the Midship Pipeline Company, LLC's Midcontinent Supply Header Interstate Pipeline Project.

After a careful review of the DSEIS, I would like to recognize FERC's efforts in its DSEIS to include important considerations of the impacts of the Midship Pipeline on the human environment in Oklahoma. FERC has demonstrated its efforts to balance its obligations under National Environmental Policy Act ("NEPA") to consider the environmental impacts (1), and under the Natural Gas Act ("NGA") to protect consumers' access to an adequate supply of gas at a reasonable price (2). I appreciate the depth of FERC's analysis, especially related to the downstream effects, and their careful consideration of comments in the previous round related to environmental issues. I recognize that NEPA requirements mean FERC must confront some very hard questions on how to value and balance the environment with our energy needs.

As a citizen, I am concerned with the long term health of our human environment. As someone with knowledge of the NEPA statute, the Council on Environmental Quality ("CEQ") regulations, and case law related to the statute and climate change, I feel it is important to point out a few areas where FERC could strengthen its analysis in the DEIS. IND1

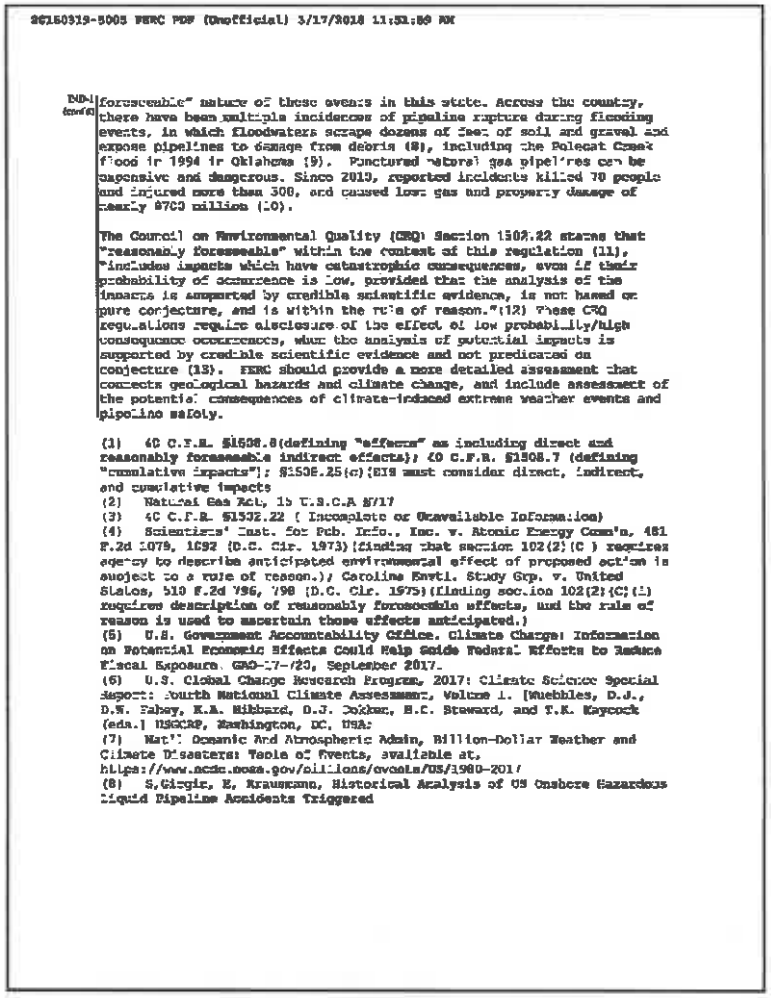
It is important that FERC ensure full consideration of the reasonably foreseeable consequences of this pipeline construction and pipeline integrity in the case of climate change-induced extreme weather events to protect Oklahoma residents from the consequences of pipeline rupture. The DEIS treats geological hazards (including flooding) in section 4.1.4. However, the DEIS only discusses climate change in very broad terms in the section on cumulative impacts (4.1.3.2.10). Thus, the DEIS is not making sufficient link between climate change and extreme weather events, and does not adequately acknowledge the "reasonably foreseeable" nature of extreme weather events. While the DEIS includes a section addressing risk of terrorism (section 4.12.4), risk of extreme weather events are as (if not more) "reasonably foreseeable" and deserve more attention in the EIS (3). NEPA is inherently forward thinking and requires FERC to consider anticipated environmental impacts (4).

Recent government reports from the Government Accountability Office (GAO; (5) and the 2017 Climate Assessment (6) indicate the extent of potential effects of climate change, outlining frequency and impacts of climate-induced natural disasters. The National Oceanic and Atmospheric Administration ("NOAA") estimated that damages and economic loss from extreme weather events in 2017 alone costs $306 billion (7).

While Oklahoma has less flooding in the past as other parts of the Midwest, extreme weather in 2015 and 2016 demonstrate the "reasonably

IND1-1 Section 4.13.2.10 of the draft EIS describes potential regional impacts associated with climate change, including the potential for more frequent extreme weather events. Sections 4.1.6 and 4.12 of the EIS describe mitigation measures and engineering standards that have been incorporated into the project design to minimize the potential for pipeline integrity concerns during extreme weather events, such as flooding. Additionally, as stated in section 4.3.2.6, all pipeline facilities would be designed and constructed in accordance with Title 49 of the Code of Federal Regulations, Part 192. These regulations include specifications for installing the pipelines at a sufficient depth to avoid possible scour at waterbody crossings. The trench would be sufficiently deep to provide a minimum of 5 feet of cover over the pipeline at waterbodies (or 18 inches in consolidated bedrock). Further, most major flowing waterbodies are proposed to be crossed using the HDD method, which would provide even greater cover over the pipeline.

IND1 – Elena Franco (cont'd)



20150918-5005 FERC PDF (Unofficial) 3/17/2018 11:53:59 AM

IND1 (cont'd)

foreseeable" nature of these events in this state. Across the country, there have been multiple incidences of pipeline rupture during flooding events, in which floodwaters scrape dozens of feet of soil and gravel and expose pipelines to damage from debris (8), including the Polecat Creek flood in 1994 in Oklahoma (9). Punctured natural gas pipelines can be expensive and dangerous. Since 2010, reported incidents killed 70 people and injured more than 300, and caused lost gas and property damage of nearly $770 million (10).

The Council on Environmental Quality (CEQ) Section 1502.22 states that "reasonably foreseeable" within the context of this regulation (11), "includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."(12) These CEQ regulations require disclosure of the effect of low probability/high consequence occurrences, when the analysis of potential impacts is supported by credible scientific evidence and not predicated on conjecture (13). FERC should provide a more detailed assessment that connects geological hazards and climate change, and include assessment of the potential consequences of climate-induced extreme weather events and pipeline safety.

(1) 40 C.F.R. §1508.8(defining "effects" as including direct and reasonably foreseeable indirect effects); 40 C.F.R. §1508.7 (defining "cumulative impacts"); §1508.25(c)(EIS must consider direct, indirect, and cumulative impacts
(2) Natural Gas Act, 15 U.S.C.A §717
(3) 40 C.F.R. §1502.22 (Incomplete or Unavailable Information)
(4) Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n, 481 F.2d 1079, 1092 (D.C. Cir. 1973)(finding that section 102(2)(C) requires agency to describe anticipated environmental effect of proposed action is subject to a rule of reason.); Carolina Envtl. Study Grp. v. United States, 510 F.2d 796, 798 (D.C. Cir. 1975)(finding section 102(2)(C)(i) requires description of reasonably foreseeable effects, and the rule of reason is used to ascertain those effects anticipated.)
(5) U.S. Government Accountability Office. Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure. GAO-17-720, September 2017.
(6) U.S. Global Change Research Program, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I. [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Steward, and T.K. Maycock (eds.)] USGCRP, Washington, DC, USA:
(7) Nat'l Oceanic And Atmospheric Admin, Billion-Dollar Weather and Climate Disasters: Table of Events, available at, https://www.ncdc.noaa.gov/billions/events/US/1980-2017
(8) S.Girgin, E. Krausmann, Historical Analysis of US Onshore Hazardous Liquid Pipeline Accidents Triggered

APPLICANT (A)

A1 – Midship Pipeline Company, LLC

MIDSHIP PIPELINE

March 29, 2018

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Re: Midship Pipeline Company LLC
Docket No. CP17-458-000
OEP/DG2E/Gas 1
Comments on DEIS and Responses to the Recommended Mitigation Measures

Dear Ms. Bose:

On May 31, 2017, Midship Pipeline Company, LLC ("Midship") submitted its Application for a Certificate of Public Convenience and Necessity and Related Authorizations pursuant to Section 7(c) of the Natural Gas Act, as amended, and the regulations of the Federal Energy Regulatory Commission ("Commission") for the construction and operation of the Midcontinent Supply Header Interstate Pipeline Project ("Midship Project").

On February 9, 2018, the Commission issued the Draft Environmental Impact Statement ("DEIS") for the Midship Project. Midship hereby submits for filing with the Commission comments on the DEIS and responses to the FERC Staff's Recommended Mitigation measures in to support the environmental review of the Midship Project.

Should you have any questions about the instant filing, please feel free to contact the undersigned at (713) 375-5344.

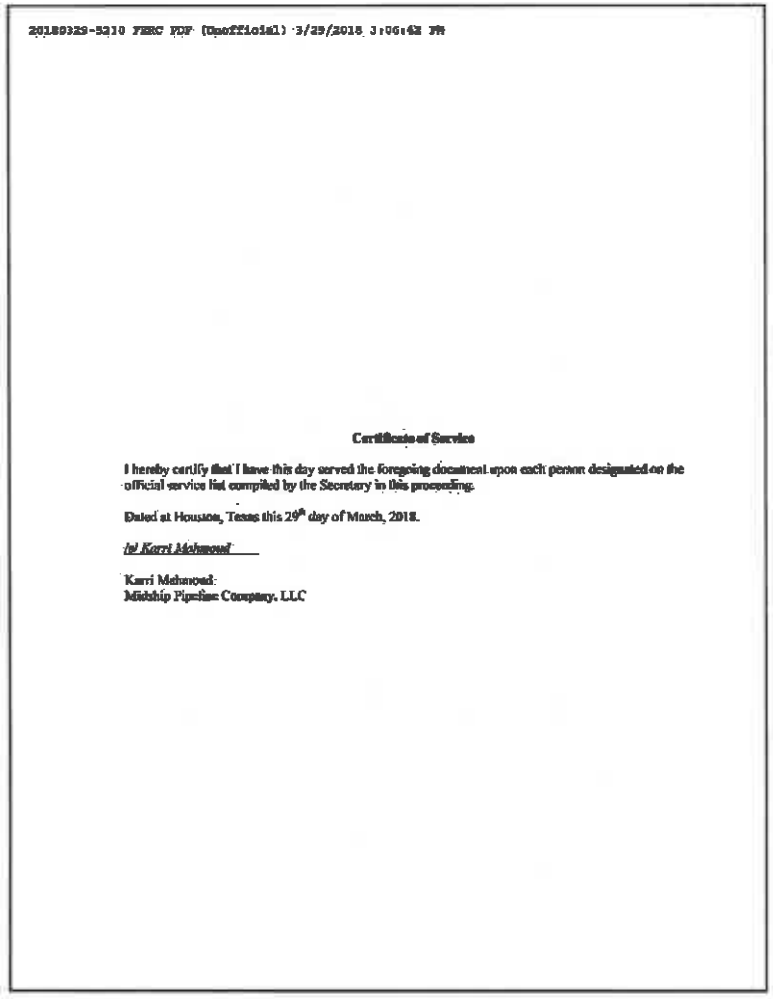
Respectfully Submitted,

/s/ Karri Mahmoud
Karri Mahmoud

Director, Regulatory Project Development
Midship Pipeline Company, LLC

Enclosures

A1 – Midship Pipeline Company, LLC (cont'd)



20180329-5210 FERC PDF (Unofficial) 3/29/2018 3:06:43 PM

Certificate of Service

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Houston, Texas this 29th day of March, 2018.

/s/ Karri Mahmoud

Karri Mahmoud
Midship Pipeline Company, LLC

A1 – Midship Pipeline Company, LLC (cont'd)

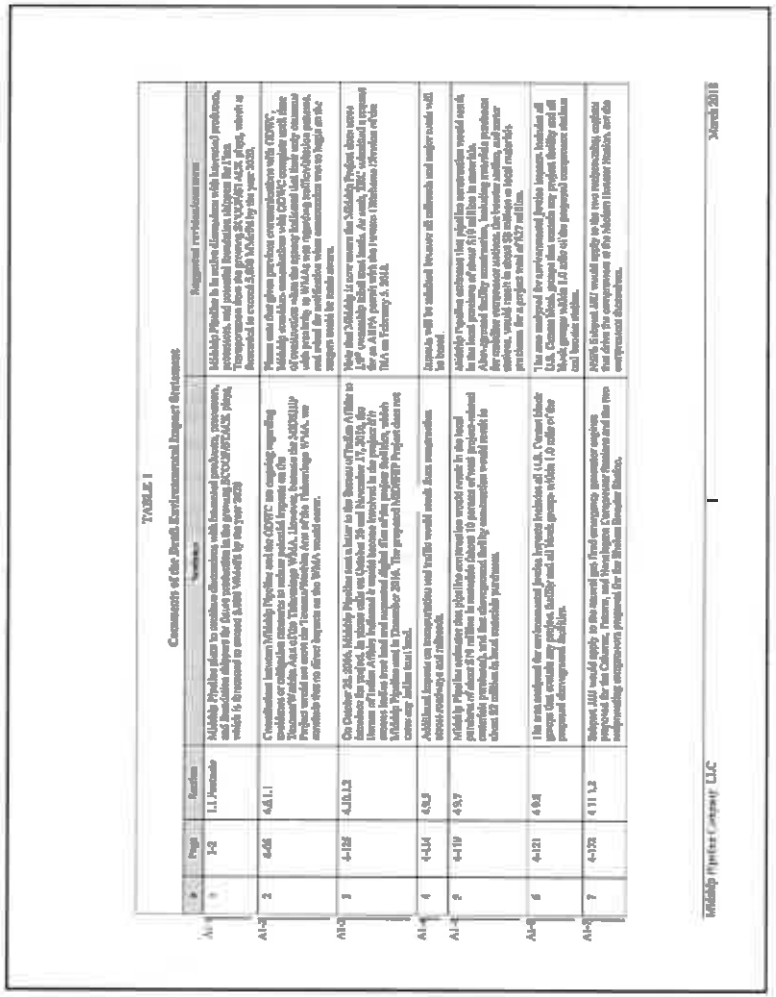


TABLE 1
Comments of the Draft Environmental Impact Statement

	#	Page	Section	Comment	Suggested revision/clarification
A1-1	1	1-2	1.1 Footnote	Midship Pipeline plans to purchase discussions with interested purchasers, procurement, and fabrication shipyard for future production in the gateway SKYCHIEF/HEALY plant, which is to transport to connect 1,000 MMscfd by the year 2020.	Midship Pipeline is in active discussions with interested purchasers, procurement, and potential fabrication shipyard for the Transportation from the gateway SKYCHIEF/HEALY plant, which is forecasted to connect 1,000 MMscfd by the year 2020.
A1-2	2	4-66	4.6.1.1	Consultation between Midship Pipeline and the ODWC on mapping regarding subsistence or cultivation resources to analyze potential impacts on the Thomas Wildlife Area of Ohio Tidewater VMAA. However, because the MIDSHIP Project would not cross the Thomas Wildlife Area or the Tidewater WMA, no avoidance would be necessary for the WMA would occur.	Please note that prior previous communications with ODWC, Midship considers consultations with ODWC complete until time of construction when the agency finalized and their only comment was pertaining to Midship not impacting particular/distinct resources, and provided no particular time commitments were to begin or the respective to avoid impacts.
A1-3	3	4-152	4.10.1.2	On October 25, 2016, Midship Pipeline sent a letter to the Bureau of Tidal Affairs to determine if the project is located within Chapter 256 and November 21, 2016, the Bureau of Tidal Affairs responded that the project is not located within the areas under land and requested digital files of the project details, which Midship Pipeline sent in December 2016. The proposed MIDSHIP Project does not cross any Indian land.	Please that Midship is of concern the Midship Project does cross [illegible] Indian land. Air code, 256, submitted a request for a determination that the Project is located within the Bureau of Tidal Affairs jurisdiction.
A1-4	4	4-134	4.9.3	Additional impacts on transportation and traffic would result from construction, access roads use and railroads.	Impacts will be additional because all railroads and major roads will be listed.
A1-5	5	4-159	4.9.7	Midship Pipeline anticipates that pipeline construction would result in the local purchase of $192 million in materials and supplies. Of the total estimated material purchases, it is the consequence of likely construction would result in about $5 million in local materials purchases.	Midship Pipeline anticipates that pipeline construction would result in the local purchase of about $192 million in materials and supplies. Additionally, it is the consequence of likely construction for pipeline construction workers, they would result in about $5 million in local materials purchases. As a project total of $197 million.
A1-6	6	4-121	4.9.8	The area analyzed for environmental justice impacts includes all U.S. Census block groups that contain any portion, facility and all block groups within 1.0 mile of the proposed development facilities.	The area analyzed for environmental justice impacts includes all U.S. Census block groups that contain any project facility and all block groups within 1.0 mile of the proposed compressor stations and border station.
A1-7	7	4-121	4.11.1.2	Subpart AAU would apply to the natural gas fired reciprocating generator engines proposed for the Coleman, Pelican, and Weeks Bay Compressor Stations and the two reciprocating compressors proposed for the Mobile Border Station.	MPPA Subpart AAU would apply to the two reciprocating engines that drive the compressors at the Mobile Border Station, not the compressor stations.

A1-1 The footnote in section 1.1 of the EIS has been revised to incorporate this information.

A1-2 Section 4.6.1.1 of the EIS has been revised to incorporate this information.

A1-3 Sections 1.5 and 4.10.1.2 of the EIS have been revised to incorporate this information.

A1-4 Section 4.9.5 of the EIS has been revised to incorporate this information.

A1-5 Section 4.9.7 of the EIS has been revised to incorporate this information.

A1-6 Section 4.9.8 of the EIS has been revised to incorporate this information.

A1-7 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1-8 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1-9 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1-10 Section 4.11.1.3 of the EIS has been updated to reflect this clarification.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

#	Description	Timing	Status	Response
4	The authorized facility locations shall be as shown in the EIS, as supplemented by filed alignment sheets. As soon as they are available, and before the start of construction, Midship Pipeline shall file with the Secretary any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. All requests for modifications of environmental conditions of the Order or site-specific clearances must be written and must reference locations designated on these alignment maps/sheets. Midship Pipeline's exercise of eminent domain authority granted under NGA section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. Midship Pipeline's right of eminent domain granted under NGA section 7(h) does not authorize it to increase the size of its natural gas facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.	Prior to Construction, but as soon as available	NA	Midship accepts this recommendation and will comply with its provisions.
5	Midship Pipeline shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP before construction in or near that area. This requirement does not apply to extra workspace allowed by the Commission's Plan and/or minor field realignments per landowner needs and requirements that do not affect other landowners or sensitive environmental areas such as wetlands. Examples of alterations requiring approval include all route realignments and facility location changes resulting from: a. implementation of cultural resources mitigation measures; b. implementation of endangered, threatened, or special concern species mitigation measures; c. recommendations by state regulatory authorities; and d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.	Prior to Construction	NA	Midship accepts this recommendation and will comply with its provisions.

Midship Pipeline Company, LLC 2 March 2018

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

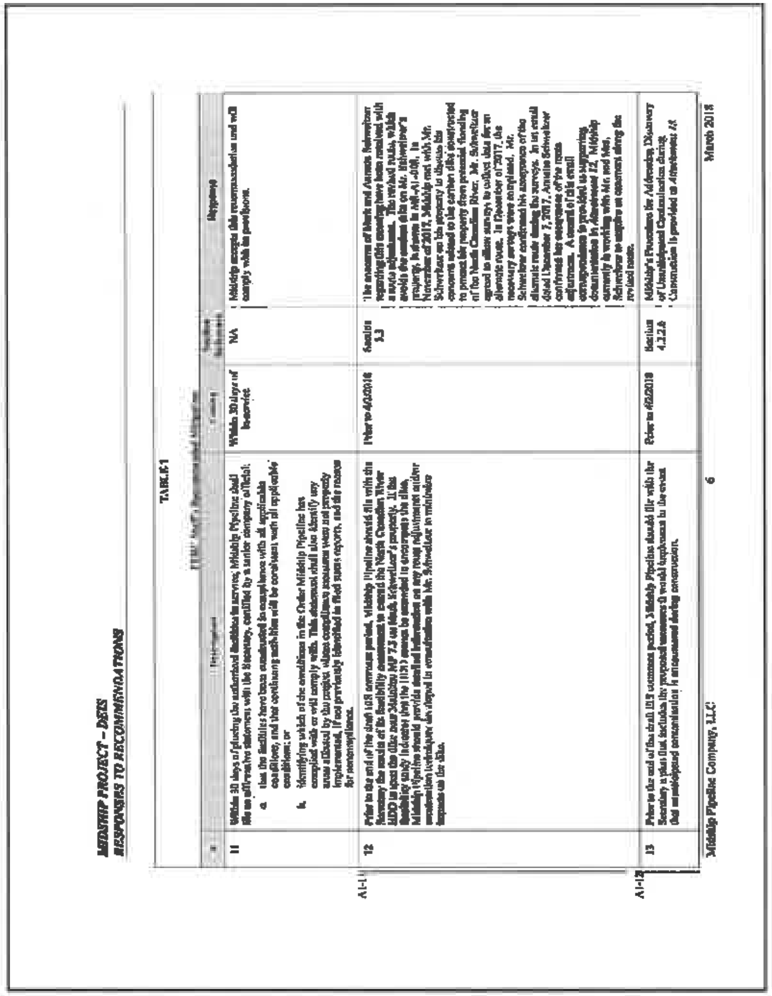
FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
7	Midship Pipeline shall employ a team of EIs (i.e., three or more or as may be established by the Director of OEP) per construction spread. The EI(s) shall be: a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents; b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document; c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document; d. a full-time position, separate from all other activity inspectors; e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental condition/permit requirements imposed by other federal, state, or local agencies; and f. responsible for maintaining status reports.	Pre-Construction	NA	Midship accepts this recommendation and will comply with its provisions.

Midship Pipeline Company, LLC 4 March 2018

Applicant

A1 – Midship Pipeline Company, LLC (cont'd)



MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

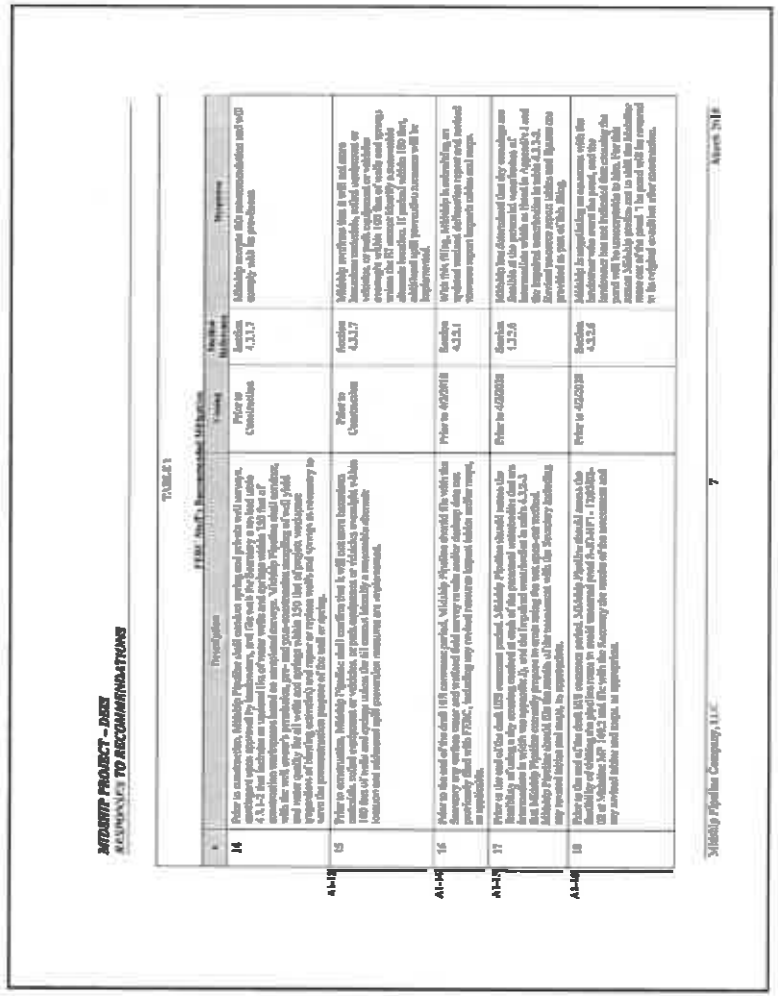
#	Recommendation	Timing	Section Reference	Response
11	Within 30 days of placing the authorized facilities in service, Midship Pipeline shall file an affirmative statement with the Secretary, certified by a senior company official: a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or b. identifying which of the conditions in the Order Midship Pipeline has complied with or will comply with. This statement shall also identify any areas affected by the project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.	Within 30 days of in-service	NA	Midship accepts this recommendation and will comply with its provisions.
12	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary the results of its feasibility assessment to extend the North Canadian River HDD to span the dike near Milepost MP 7.5 on Mark Schweitzer's property. If the feasibility study indicates that the HDD cannot be extended to encompass the dike, Midship Pipeline should provide detailed information on any route adjustment and/or construction techniques developed in consultation with Mr. Schweitzer to minimize impacts on the dike.	Prior to 4/2/2018	Section 3.3	The concerns of Mark and Annette Schweitzer regarding this crossing have been resolved with a route adjustment. The revised route, which avoids the earthen dike on Mr. Schweitzer's property, is shown in MR-A1-008. In November of 2017, Midship met with Mr. Schweitzer on his property to discuss his concerns related to the earthen dike constructed to protect his property from potential flooding of the North Canadian River. Mr. Schweitzer agreed to allow surveys to collect data for an alternate route. In December of 2017, the necessary surveys were completed. Mr. Schweitzer confirmed his acceptance of the alternate route during the surveys. In an email dated December 7, 2017, Annette Schweitzer confirmed her acceptance of the route adjustment. A record of this email correspondence is provided as supporting documentation in Attachment 12. Midship currently is working with Mr. and Mrs. Schweitzer to acquire an easement along the revised route.
13	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a plan that includes the proposed measures it would implement in the event that unanticipated contamination is encountered during construction.	Prior to 4/2/2018	Section 4.2.2.6	Midship's Procedures for Addressing Discovery of Unanticipated Contamination during Construction is provided as Attachment A.

Midship Pipeline Company, LLC 6 March 2018

A1-11 Section 3.3 of the EIS has been revised to incorporate this information.

A1-12 Section 4.2.2.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)



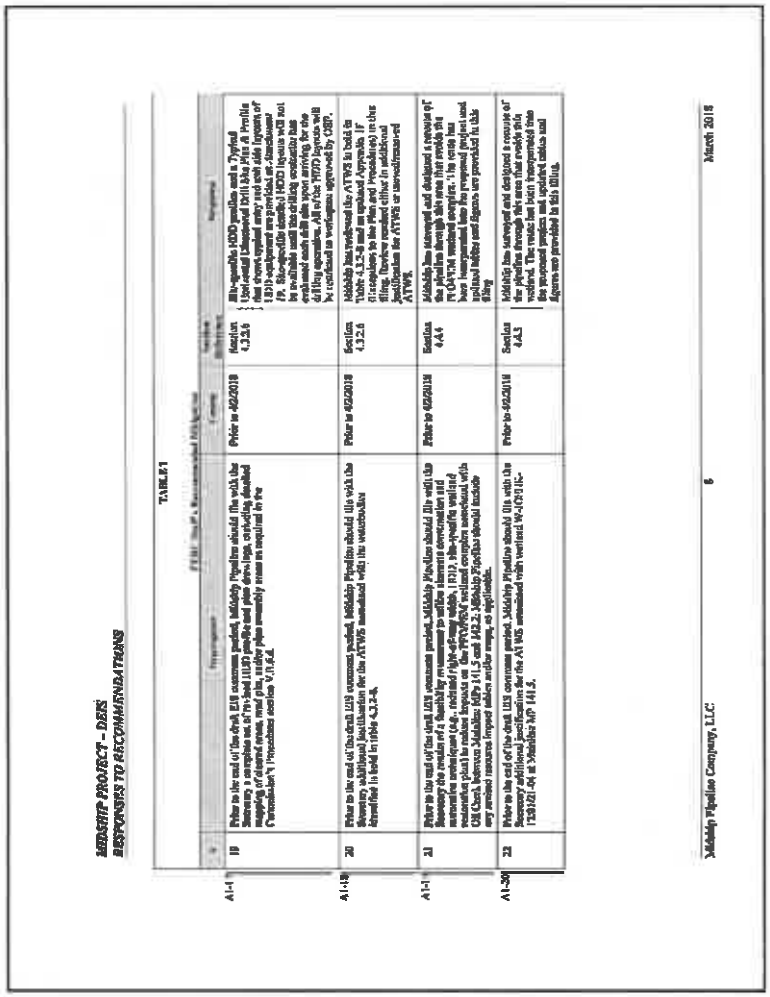
A1-13 Section 4.3.1.7 of the EIS has been revised to incorporate this information.

A1-14 Sections 4.3.2 and 4.4.1 of the EIS have been revised to incorporate this information.

A1-15 Section 4.3.2.5 and appendix J to the EIS has been revised to incorporate this information.

A1-16 Section 4.3.2.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)



MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 5.1

		Prior to construction of:	Timing	Section Reference	Requirement
A1-17	19	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary, for review and approval by the Director of OEP, all additional mapping of disturbed areas, wetland delineations, and photo logs, not filed as part of the Construction Procedures section V.B.6.d.	Prior to 4/5/2019	Section 4.3.2.6	Blue-specific HDD profiles and a Typical Use-specific Shallow and Drill Data Alert A Profile that shows updated entry and exit side layouts of 1319-calvert are provided at Attachment 19. Blue-specific detailed HDD layouts will not be available until the drilling contractor has established each side upon arriving for the drill. Blue-specific profiles and plan views will be filed as soon as available, after the HDD contractor is selected and prior to construction.
A1-18	20	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary additional justification for the ATWS associated with the watercrossing identified in table 4.3.2-6.	Prior to 4/5/2019	Section 4.3.2.6	Midship has reviewed the ATWS in table in table 4.3.2-6 and an updated Appendix 1F ATWS table has been provided with this filing. Dockets received either in additional justification for ATWS or unmodified and ATWS.
A1-19	21	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary the results of a detailed log crossing to utilize alternate construction and restoration techniques (e.g., restricted right-of-way width, HDD, pile-mattress wetland restoration plans) to reduce impacts on the PFO/PEM wetland complex associated with Oil Creek, between Mainline MPs 141.5 and 142.2. Midship Pipeline should include any revised resource impact tables and/or maps, as applicable.	Prior to 4/5/2019	Section 4.4.4	Midship has surveyed and designed a crossing of the pipeline through this area that avoids this PFO/PEM wetland complex. The route has been incorporated into the proposed project and updated tables and figures are provided in this filing.
A1-20	22	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary additional justification for the A1 WS associated with wetland W-CR2 (IC-123/121-04 at Mainline MP 141.5.	Prior to 4/5/2019	Section 4.4.5	Midship has surveyed and designed a crossing of the pipeline through this area that avoids this wetland. The route has been incorporated into the proposed project and updated tables and figures are provided in this filing.

Midship Pipeline Company, LLC 6 March 2019

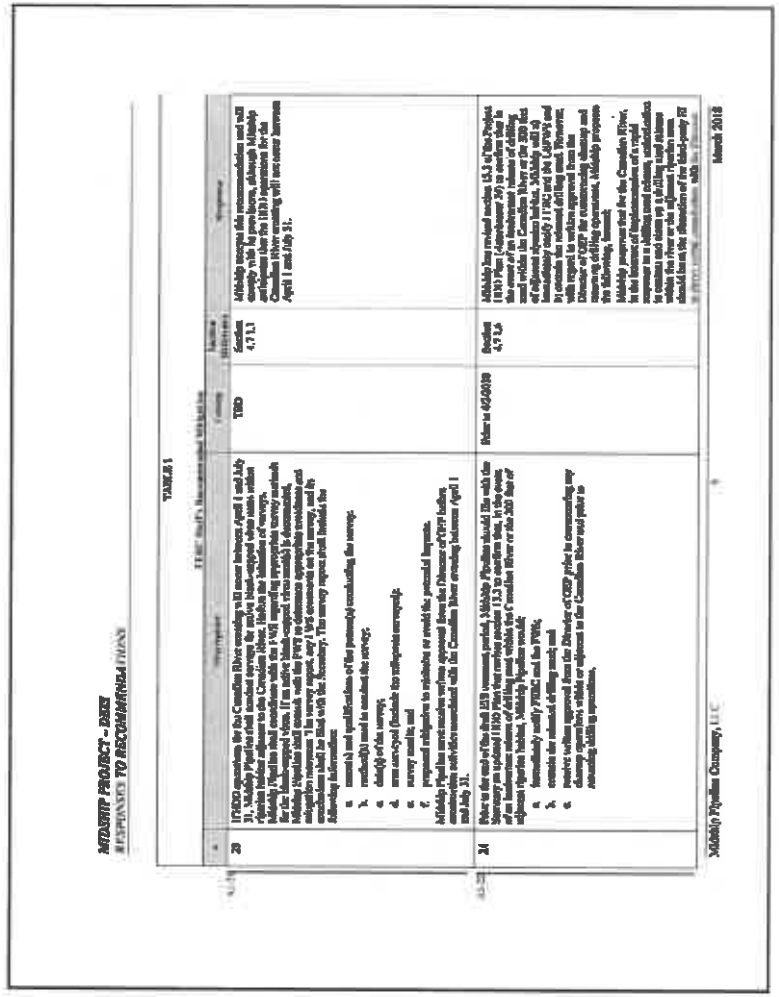
A1-17 Section 4.3.2.6 of the EIS has been revised to incorporate this information. Because the Henry House Creek HDD crossing lacks survey permission and geotechnical data, we are recommending Midship Pipeline file this information prior to construction.

A1-18 Section 4.3.2.6 of the EIS has been revised to incorporate this information. However, several additional temporary workspaces within 50 feet of waterbodies require additional site-specific justification. We are recommending Midship Pipeline file this information prior to construction.

A1-19 Section 4.4.4 of the EIS has been revised to incorporate this information.

A1-20 Section 4.4.5 of the EIS has been revised to incorporate this information.

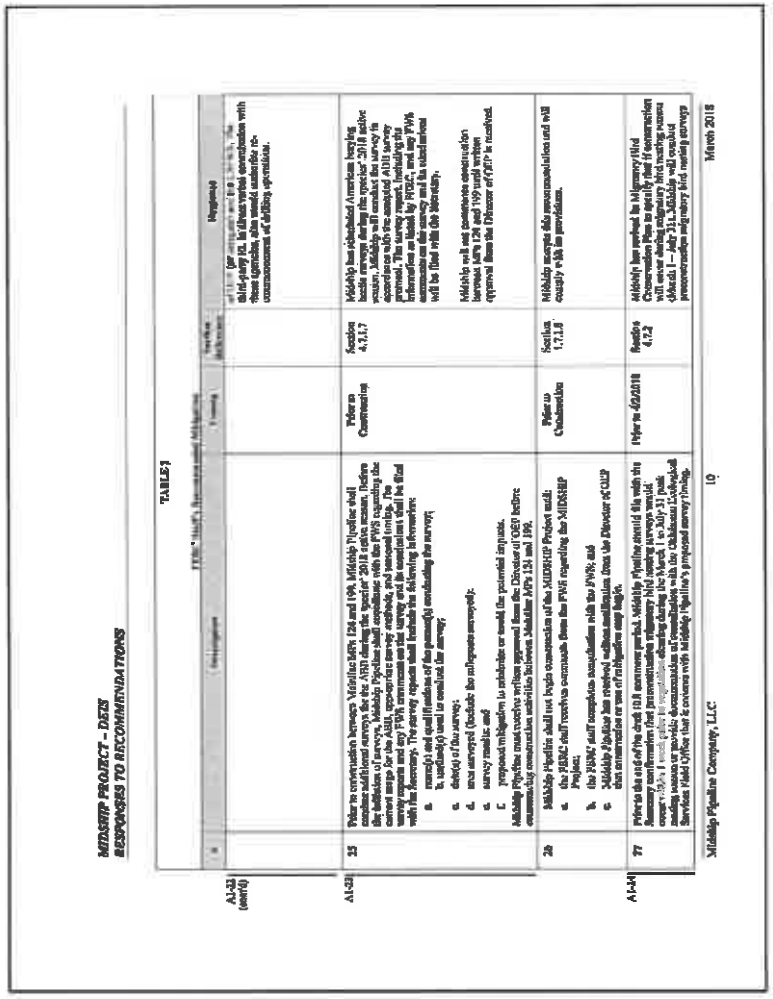
A1 – Midship Pipeline Company, LLC (cont'd)



A1-21 Section 4.7.1.1 of the EIS has been revised to incorporate this information.

A1-22 Section 4.7.1.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)



MIDSHIP PROJECT - DEIS
RESPONSES TO RECOMMENDATIONS

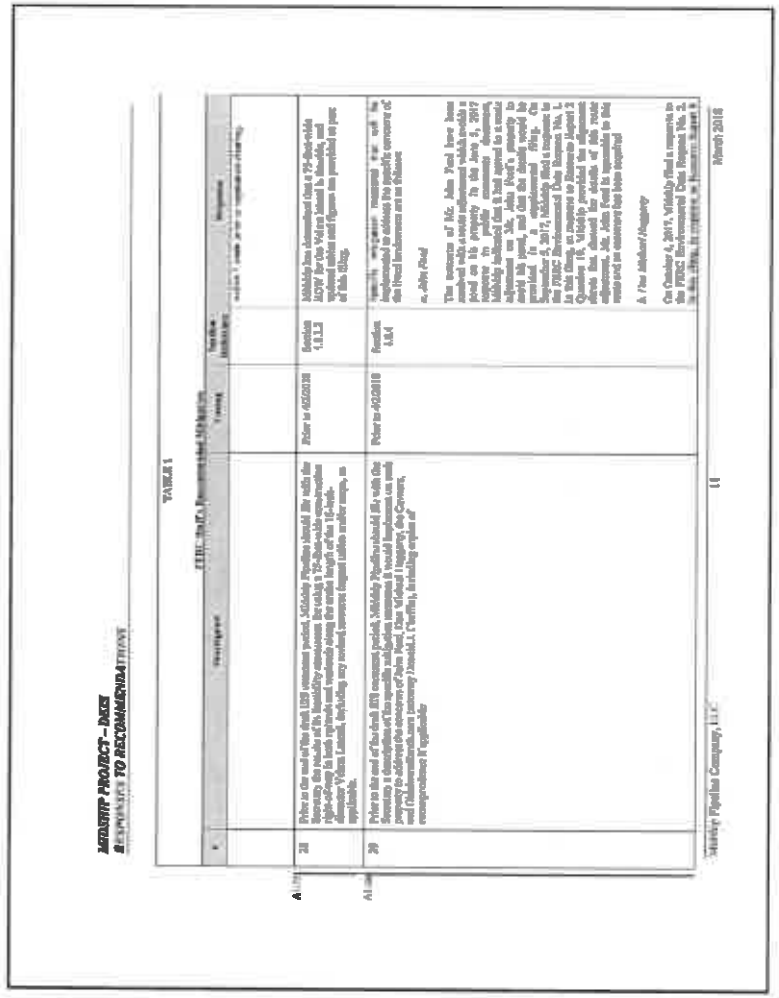
TABLE 1

A1-23 (cont'd)							
A1-24	23	Prior to construction hamess, Monitor MPs 134 and 199, Midship Pipeline shall consult with resource agencies, the ANH during the summer 2018 active season, federal the schedule of surveys, Midship Pipeline shall coordinate with the FWS regarding the correct maps for the ANH, appropriate survey methods, and seasonal limits. The survey report and any FWS comments on the survey and its conclusions shall be filed with the Secretary. The survey report shall include the following information: a. survey(s) and qualifications of the person(s) conducting the survey; b. method(s) used to conduct the survey; c. date(s) of the survey; d. area surveyed (include the mileposts surveyed); e. survey results; and f. proposed mitigation to minimize or avoid the potential impacts. Midship Pipeline must receive written approval from the Director of OEP before commencing construction activities between Milepost MPs 134 and 199.	Prior to Construction	Section 4.7.1.7	Midship has scheduled American hanging bottle surveys during the spring 2018 active season. Midship will conduct the survey in accordance with the accepted ANH survey protocol. The survey report, including the information as listed by FERC, and any FWS comments on the survey and its conclusions will be filed with the Secretary. Midship will not commence construction between MPs 134 and 199 until written approval from the Director of OEP is received.	
	29	Midship Pipeline shall not begin construction of the MIDSHIP Project until: a. the FERC staff receives comments from the FWS regarding the MIDSHIP Project; b. the FERC staff completes consultation with the FWS; and c. Midship Pipeline has received written notification from the Director of OEP that construction or use of mitigation may begin.	Prior to Construction	Section 1.7.1.8	Midship accepts this recommendation and will comply with the provision.		
A1-25	77	Prior to the end of the draft 2018 comment period, Midship Pipeline should file with the Secretary confirmation that pre-construction migratory bird nesting surveys would occur within the project's construction workspace during the March 1–July 31 breeding season. The applicant should also consult with the U.S. Fish and Wildlife Service Field Office that is overseen with Midship Pipeline's proposed survey timing.	Prior to 4/2/2018	Section 4.7.2	Midship has worked to implement Bird Conservation Plan to specify that if construction activities occur during the migratory bird season (March 1 – July 31), Midship will conduct pre-construction migratory bird nesting surveys		

A1-23 Section 4.7.1.7 of the EIS has been revised to incorporate this information.

A1-24 Section 4.7.2 of the EIS has been revised to incorporate this information.

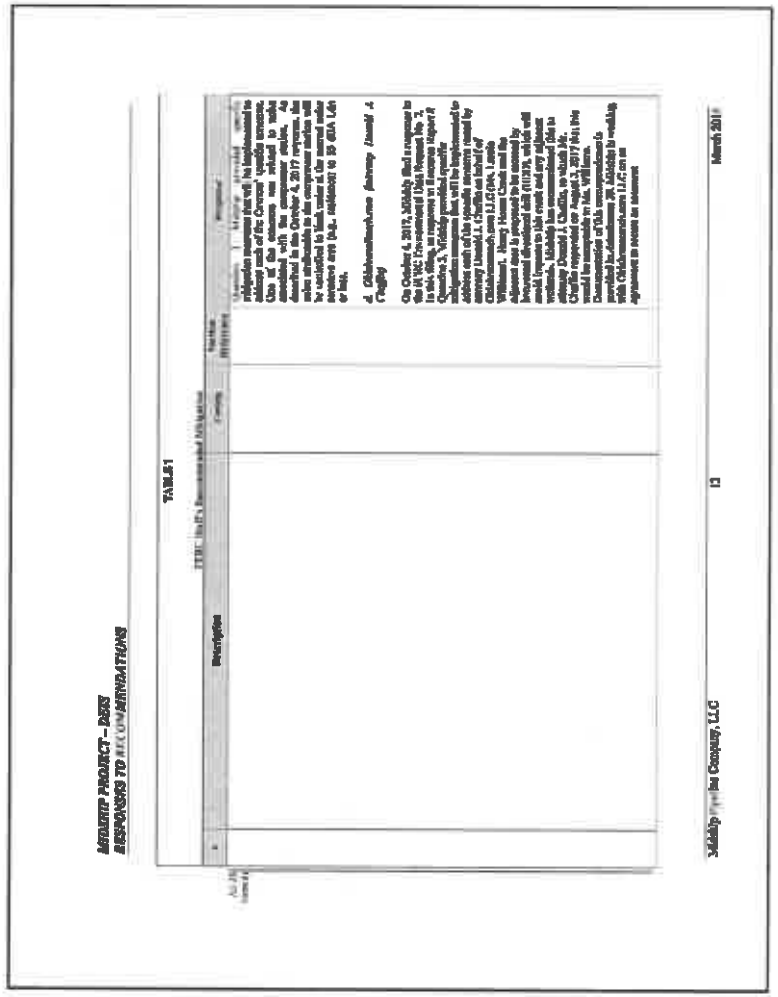
A1 – Midship Pipeline Company, LLC (cont'd)



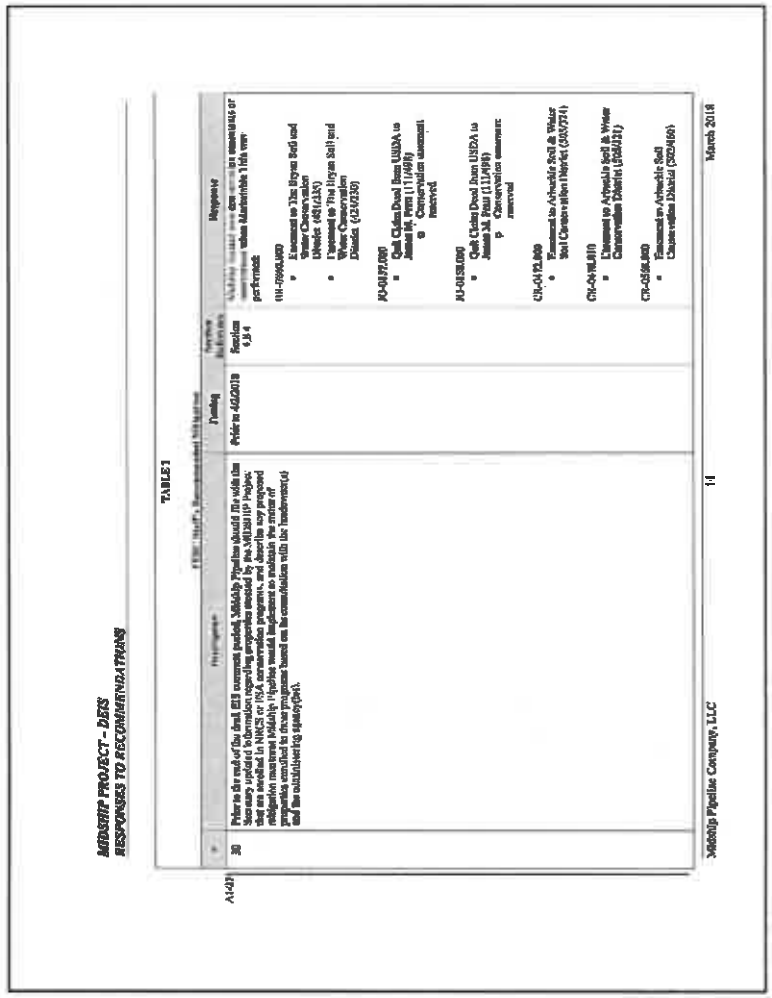
A1-25 Sections 2.2.2 and 4.8.1.2 of the EIS have been revised to incorporate this information.

A1-26 Section 4.8.4 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)



A1 – Midship Pipeline Company, LLC (cont'd)



MIDSHIP PROJECT - DEIS
RESPONSES TO RECOMMENDATIONS

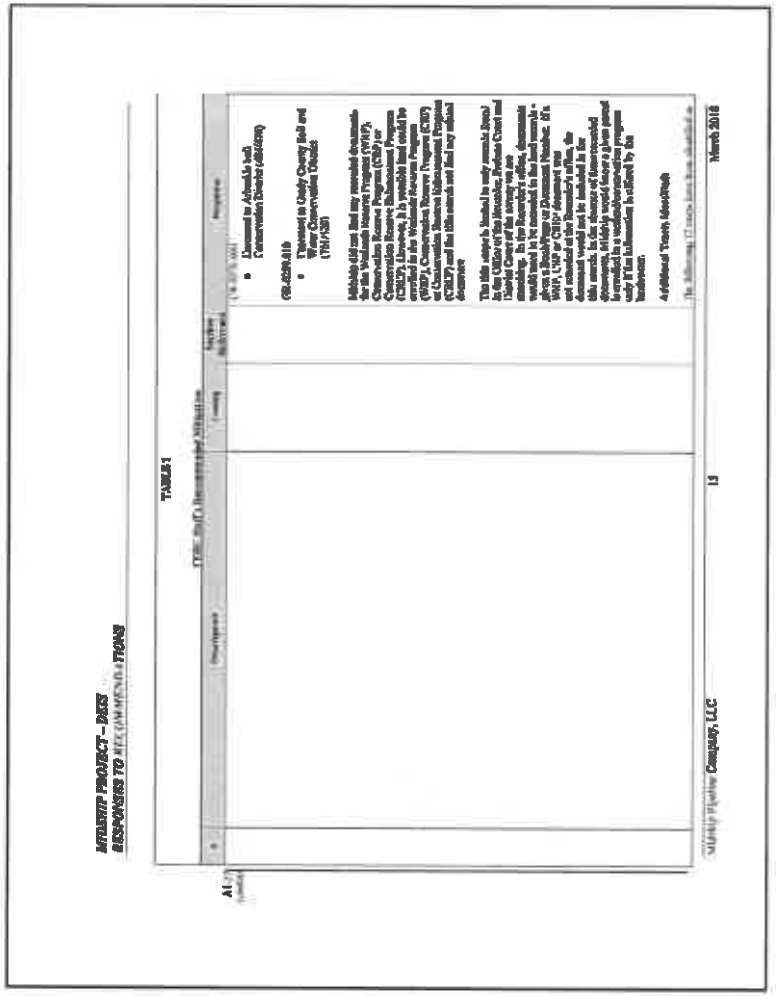
TABLE 1

A1-27	30	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary updated information regarding properties enrolled by the NRCS or FSA conservation programs, and describe any proposed mitigation measures Midship Pipeline would implement to maintain the status of properties enrolled in these programs based on the consultation with the landowner(s) and the establishing agency(ies).	Prior to 4/2/2018	Section 4.8.4

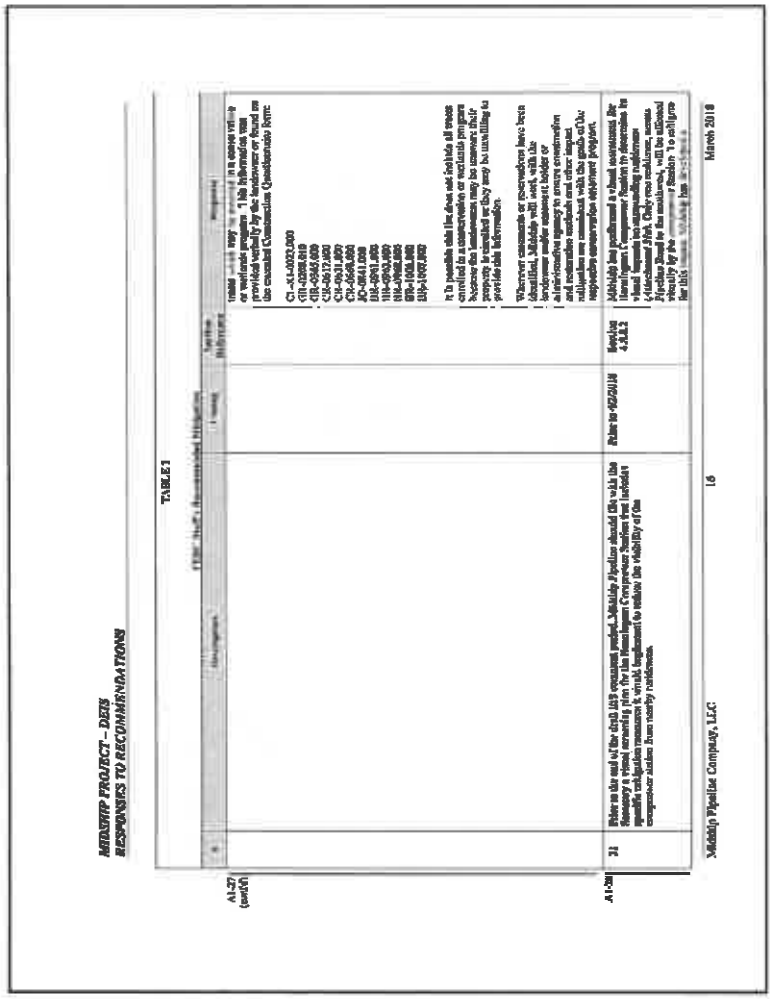
Midship Pipeline Company, LLC — 11 — March 2018

A1-27 Section 4.8.4 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)



A1 – Midship Pipeline Company, LLC (cont'd)



MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

A1-27 (cont'd)						
A1-28	31	Before the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a revised screening plan for the Interstate Compressor Station that includes specific installation measures it would implement to reduce the visibility of the compressor station from nearby residences.	Refer to 4.8.8.1.1	Revise 4.8.8.2	Midship has performed a visual assessment for the Interstate Compressor Station to determine its visual impacts to surrounding residences (Attachment 24A). Only road residences, access Pipeline Road to the southwest, will be affected directly by the [illegible] Station. To mitigate for this [illegible]	March 2018

Midship Pipeline Company, LLC 16

A1-28 Section 4.8.8.2 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

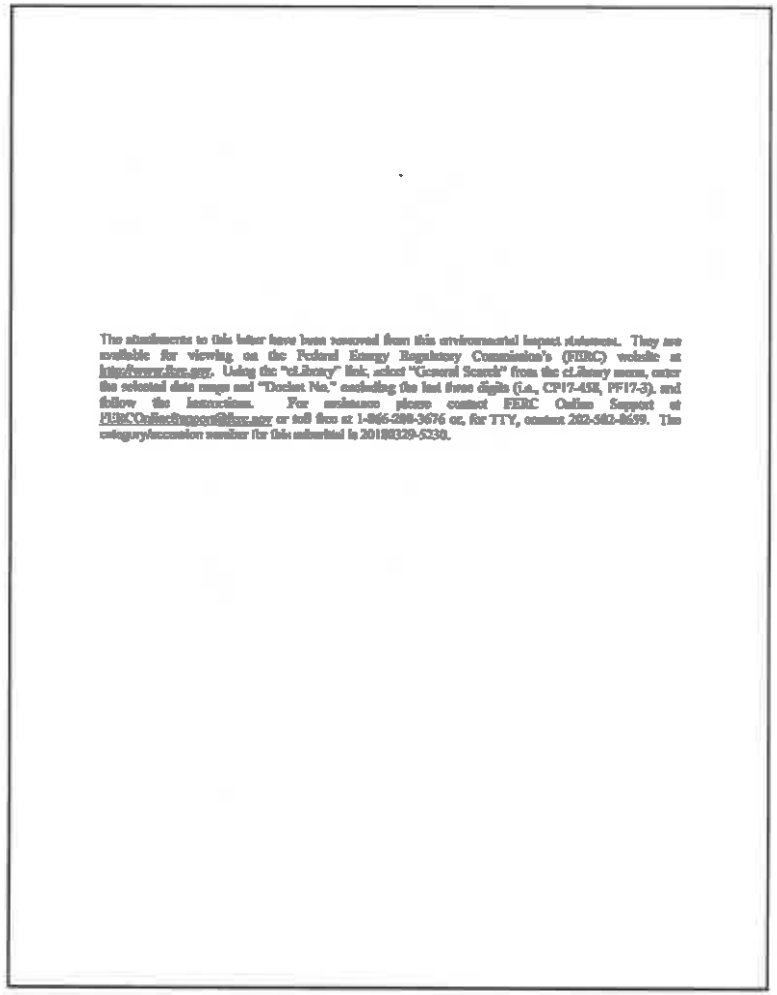
TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
34	With its Implementation Plan, Midship Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, an HDD noise assessment for the North Canadian River; Oklahoma, Kansas and Texas Railroad; Blue River; and Rock Creek HDDs. The HDD noise assessment shall include: a. a detailed list of the noise mitigation measures Midship Pipeline will implement at each HDD entry/exit site; and b. the predicted noise attributable to HDD activities at each entry/exit site with implementation of the proposed noise mitigation measures that demonstrates that noise levels associated with HDD activities will be reduced to less than 55 dBA Ldn at the nearest NSA.	With its Implementation Plan	Section 4.11.2.2	Midship accepts this recommendation and will comply with its provisions.
35	Midship Pipeline shall file noise surveys with the Secretary no later than 60 days after placing the Calumet, Tatums, and Bennington Compressor Stations and the Sholem Booster Station in service. If a full load condition noise survey is not possible, Midship Pipeline shall provide an interim survey at the maximum possible horsepower load and provide the full load survey within 6 months. If the noise attributable to the operation of any of the compressor or booster stations under interim or full horsepower load conditions exceeds an Ldn of 55 dBA at any nearby NSAs, Midship Pipeline shall file a report on what changes are needed and shall install the additional noise controls to meet the level within 1 year of the in-service date. Midship Pipeline shall confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.	no later than 60 days after in service	Section 4.11.2.2	Midship accepts this recommendation and will comply with its provisions.

Midship Pipeline Company, LLC 18 March 2018

A1 – Midship Pipeline Company, LLC (cont'd)


The attachments to this letter have been removed from this environmental impact statement. They are available for viewing on the Federal Energy Regulatory Commission's (FERC) website at http://www.ferc.gov. Using the "eLibrary" link, select "General Search" from the eLibrary menu, enter the selected date range and "Docket No." excluding the last three digits (i.e., CP17-458, PF17-3), and follow the instructions. For assistance please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676 or, for TTY, contact 202-502-8659. The category/accession number for this submittal is 20180329-5330.

APPENDIX P

INDEX

20180621-3006 FERC PDF (Unofficial) 06/21/2018

Document Content(s)